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SMITHSONIAN INSTITUTE

THE AMERICAN

# GAS LIGHT JOURNAL

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[OFFICIAL NOTICE.]

## Annual Meeting, American Gas Light Association.

OFFICE OF THE SECRETARY, MONTCLAIR, N. J., Sept. 6, 1898.

There will be an annual meeting of the American Gas Light Association held at Niagara Falls, N. Y., on Oct. 19, 20 and 21, 1898.

The meeting will be called to order by the President, Joseph B. Crockett, of San Francisco, Cal., at 10 A.M., on Wednesday, Oct. 19, in the meeting hall at the International Hotel, the headquarters.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The International Hotel is conducted on the American plan, and rates are as follows:

Large parlors on first floor, $3.50 per day; all rooms on second and third floors, $3 per day; rooms with bath, $4 per day. At that season of the year we will be able to have the whole house.

The meeting hall will be on the parlor floor of the International Hotel; thus the headquarters and hall will be in the same building.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of application for membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the Secretary's hands by Oct. 9, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"The Effect of the Depth of Fire upon the Practical Efficiency of a Water Gas Generator," by Mr. J. M. Rusby, Jersey City, N. J.

"Notes on Mains and Main Laying," by Mr. Walton Forstall, Philadelphia, Pa.

"The Loss of Illuminating Power of 25 to 30-Candle Gas when Mixed with Air," by Dr. E. G. Love, New York city.

Another paper is promised, the title and authorship of same to be announced later on.

In addition to the above there will be short topics by Mr. H. L. Doherty, Madison, Wis., Mr. E. G. Cowdery, Milwaukee, Wis., Mr. H. L. Rice, Norfolk, Va., and Mr. Irvin Butterworth, Columbus, O.

In accordance with the action taken by the Council and the Association last year, the Beal Medal will be awarded to the author of the best paper presented at this meeting; the question of which is best to be decided by a committee of three past Presidents, appointed by the President.

All questions for the Question Box should be sent to the Secretary as soon as possible, in order that they may be printed in the next circular before the meeting, thereby insuring their discussion.

During the days of the meeting all announcements will be posted on the bulletin board in the meeting room. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers of the local committee in their work by affording a ready means of recognition.

In order that the Year-book containing the report of this meeting may be published and issued to the members immediately after the meeting—

Notice is hereby given, that if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Niagara Falls, but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted (viz., full fare going and one third fare returning by the same route) by the several passenger associations named and under the conditions noted:

The Trunk Line Passenger Committee, covering the territory west of New England and east of Niagara Falls, Buffalo and Salamanca, N.Y.; Pittsburg, Pa.; Bellaire, O.; Wheeling, Parkersburg and Charleston, W. Va.

The New England Passenger Association, covering nearly all of the lines in the New England States.

The Central Passenger Association, covering the territory bounded on the east by Pittsburg, Salamanca, Buffalo and Toronto; on the north by the line of and including points on the Grand Trunk Railway from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook county, Illinois; on the west by the west line of Cook county and the Illinois and Mississippi rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, including points on either side of that river.

The Southeastern Passenger Association, covering the territory south and west of the Virginias and south and east of the Ohio and Mississippi rivers, and the Western Passenger Association, covering the territory west of and not including Chicago, Peoria and St. Louis, in other words, the territory west of that of the Central Association, have refused to grant the rates. Members from these territories should buy tickets from starting point to the nearest or most convenient point in the territory of any of the Associations granting the reduced rates, and at such point purchase tickets through to Niagara Falls and obtain a certificate.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations:

*First.* The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

*Second.* Each person to obtain the excursion rate must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

*Third.* If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through ticket can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where each purchase is made.

*Fourth.* Tickets for the return journey will be sold by the ticket agent at the place of meeting at one-third the highest limited fare only to those holding certificates, signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

*Fifth.* No reduction of fare will be made on the return passage if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

*Sixth.* Certificates are not transferable, and return tickets secured upon certificates are not transferable. The transfer of any such is liable to prevent the securing of reduced rates for future meetings.

*Seventh.* The certificate of agent at starting point, duly endorsed by Secretary of Association, must be presented to ticket agent at place of meeting, within three days (Sunday not reckoned) after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

*Eighth.* No refund of fare will be made on account of any person failing to obtain a certificate.

*Special.*

If a sufficient number of subscriptions are obtained, the social programme will be as follows: Wednesday evening, reception and hop; Thursday evening, banquet to which ladies will be admitted on equal footing with the gentlemen; Friday evening, informal hop; Wednesday and Thursday, carriage drives for the ladies; Friday, visit the Niagara Falls power house and other places of interest, and trolley ride down Gorge Route to Lewiston and return.

Tickets admitting members and friends to these entertainments can be had for $5 each. If you wish to join in them please sign inclosed card and return to the Secretary at once. It will be necessary to have at least 100 subscriptions.

Be sure to obtain your railroad certificate when buying your ticket for Niagara Falls, as the greater the number of certificates handed in, the easier it is to get the reduction in rates for future meetings.

Apply for tickets and certificates at least 30 minutes before train time.

Each person must sign his own certificate at time of purchasing for Niagara Falls.

Be sure to hand the Secretary your certificate as soon as you reach the headquarters.

Apply for return ticket at least 30 minutes before train time, and have your certificate with you.

Any person, ladies included, attending the meeting, is entitled to the reduced rate from the territories named.

Members will please hand their certificates to the Secretary, or his clerk, upon arrival at place of meeting. If there are 100 members present, holding certificates, each certificate will then be properly indorsed and handed back to owner, before adjournment.

*Extracts from the Constitution.*

Sec. 12. Application for active membership, or for associate membership, or for transfer from associate to active membership, must be received by the Secretary at least 10 days prior to the meeting at which the application is acted on.

Sec. 51. No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.

Sec. 52. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council.

ALFRED E. FORSTALL, Secretary.

## BRIEFLY TOLD.

THE SUBSCRIPTION TO THE PROPOSED EDUCATIONAL FUND.—The Committee to secure the fund necessary to carry on the educational work of the American Gas Light Association has met with more than fair success during the week. The list at present numbers 39 separate subscribers, the total sum of whose pledges amounts to $12,010, which, spread over the 5-year period, estimated by the Committee as the time needed to thoroughly demonstrate the value of the educational system to the fraternity at large, also amounts to $2,402 per annum. As heretofore noted the Committee deems that $3,000 per annum will be the revenue required to sustain the work in hand, and in view of the fact that $598 per annum is the sum remaining to be subscribed, we may take it for granted that such amount will be speedily pledged. The list of subscriptions as published last week contained an error, which error was in respect of the subscription of Mr. F. C. Sherman, of New Haven, Conn. Mr. Sherman was reported as having pledged the sum of $20, or $4 per annum for the 5-year term; but in reality his pledge was $100, or $20 per annum for the five years. The list of subscribers, up to the 13th inst., is appended:

| Subscriber. | Total Amount Pledged. | Amount per Year Through 5-Year Period. |
|---|---|---|
| Akron (O.) Gas Light Company | $75 | $15 |
| American Gas Company, Phila., Pa | 1,000 | 200 |
| American Gas Light Journal | 125 | 25 |
| Auburn (N. Y.) Gas Light Company | 50 | 10 |
| Austin (Tex.) Gas Light and Coal Company | 50 | 10 |
| Barber, Chas. W | 10 | 2 |
| Blodget, C. W., Brooklyn, N. Y. | 50 | 10 |
| Binghamton (N. Y.) Gas Works | 50 | 10 |
| Buffalo City (N. Y.) Gas Company, " " Gas Light Company, " " Mutual Gas Light Co. | 500 | 100 |
| Clark, Walton, Phila., Pa | 600 | 120 |
| Cleveland (O.) Gas Light and Coke Company | 500 | 100 |
| Collins, C. R., Seattle, Wash | 10 | 2 |
| Columbus (O.) Gas Company | 125 | 25 |
| Connelly Iron Sponge and Governor Co., N.Y. | 50 | 10 |
| Consolidated Gas Company, of New Jersey | 100 | 20 |
| Crisfield, J. A. P., Savannah, Ga | 10 | 2 |
| Daniels, Jno. M | 25 | 5 |
| Derby (Conn.) Gas Light Company | 100 | 20 |
| Detroit (Mich.) City Gas Company | 200 | 40 |
| Dunbar, J. W., New Albany, Ind | 50 | 10 |
| Equitable Gas and Electric Co., Utica, N. Y. | 10 | 2 |
| Grand Rapids (Mich.) Gas Light Company | 125 | 25 |
| Griffin, Jno. J. & Co., Phila., Pa | 250 | 50 |
| Helme & McIlhenny, Phila., Pa | 250 | 50 |
| Humphreys & Glasgow, New York and London | 1,000 | 200 |
| Lawrence, W. F., Trenton, N. J | 25 | 5 |
| Love, Dr. E. G., New York | 50 | 10 |
| Maryland Meter & Mfg. Co., Baltimore | 250 | 50 |
| Miller, A. S., New York | 125 | 25 |
| Nettleton, C. H., Derby, Conn | 125 | 25 |
| Norwich (Conn.) Gas Light Company | 125 | 25 |
| Old, G | 25 | 5 |
| Roots, P. H. & F. M. Co., Connersville, Ind | 125 | 25 |
| Sherman, F. C., New Haven, Conn | 100 | 20 |
| St. Paul (Minn.) Gas Light Company | 125 | 25 |
| Turner, Thomas, Charleston, S. C | 20 | 4 |
| United Gas Improvement Company, Phila., Pa. | 5,000 | 1,000 |
| Vanderpool, Eugene, Newark, N. J | 500 | 100 |
| White, W. H., New York | 100 | 20 |
| Total | $12,010 | $2,402 |

NOTES.—Every indication is that the meeting at Niagara Falls this week, of the American Gas Light Association, will be a complete success. In any event, the officers and the committees have left nothing undone that should have been done to make the convention a notable one in the history of the Association's assemblies.——Superintendent F. H. Hess, of the new Mount Clemens (Mich.) Gas Company, has about completed the manufacturing plant, which he hopes to have in operation by the 1st prox. A feature of the generating apparatus (it is a 4-foot Lowe set) is that it can be operated either from the ground or from an upper floor.

[Communicated Article.]

## The Manufacture of "Oxide" in the Gas Works, from the Standpoint of the Man Outside.

By Dr. W. H. Birchmore.

About once in so often, be the time measured by days, weeks, months or years, the hard working, and almost invariably perfectly conscientious superintendent of the gas house, asks himself, "Does my duty to my employers require me to make my own oxide?"

It seems destined that this question must be asked; but how shall it be answered? Is it the duty of the gas works manager to make his own oxide, or shall he purchase from a manufacturer an oxide, so-called, of known power of purification, carefully prepared by skilled workmen under still more skilled supervision?

Probably this question has been more discussed and more written upon than any other relating to the details of gas making, but the discussion with living voice or pen and ink in every instance takes on a controversial tone. The men preparing the papers seem to feel chips upon their shoulders and, unconsciously of course, appear to be inviting some one to knock them off. This attitude is deplorable and has undoubtedly hindered the advancement of knowledge in reference to this important factor, and has been the cause of loss of revenue to the gas companies themselves as well as others.

Without paying any attention to the methods of making the product, the men who make their own oxide may be divided into two classes. Those who do it in spite of themselves, against their own will as it were, but urged so to do by their sense of what is due their employers; and those who do it for the sake of doing it, for the sake of trying some private notion, testing some theory or the like. Of those in the second class some are skilled men and competent chemists, some by a system of continuous endeavor have developed something of a special product, others knowing that the manufacture of the oxide is becoming more and more a specialized business seek to make it in order to convince themselves that they are "chemists," much after the train of reasoning indulged in by the "boy" in "A Scrap of Paper" to prove himself a man. On these men the fact that oxide making is regarded as a subject for special study by expert chemists acts as a lure, entices them to dangerous play, as matches children, and they fancy that can they but make oxide they will thereby place themselves among the said expert chemists. Thus convinced of their duty to make oxide they rush with a light heart and resounding tread into precincts which are hallowed if not holy, precincts which the experts enter with due sense of their own dignity and in white raiment.

This adds to the difficulty of obtaining a fitting interchange of views. The men who make for sale various grades of oxide are provoked at the incredulity of those who do not use their product and at the indifference of those who do. While the men who make their own oxide are unable to understand much of the views of the oxide makers, as, having so many other things to attend to, all the detail of oxide making is forgotten save the fact that it is made according to a certain formula, usually expressed in so many "wettings," and a certain proportion of iron to shavings.

In visiting various gas manufactories and sampling their oxide the first thing noticed is the wide variation among them. One is at a loss to say which is the more interesting, the difference in the oxide or the difference in the opinions about it.

The numerous materials, of course, insure great differences in the product; but this is lost sight of, and all alike are ready to declare that "oxide is oxide." In point of fact it is no such thing. Setting aside the differences arising from the use of the ferrous sulphate (copperas), "turnings," "borings," either cast or wrought, and the question of an oxidation process whose first term is sulphur action as opposed to chlorine, or the mixed reactions, which certainly are variable enough, there remain the differences in texture which are so important in practice.

Why will some samples of oxide replace eight oxygen atoms by sulphur and others only two? Why are some samples for ever getting hot and others never? (The explanations given really explain nothing.) And why do some samples revivify so well and so easily, while others will not do so at all. Besides these differences, which any one can see, are others which show themselves only to the men in white raiment, but which are not beyond discussion here.

Let us first of all understand what we mean when we say hydrated peroxide of iron. To determine this I have examined the literature bearing on the subject for the last 25 years, and in doing so I have found beyond all doubt that if the writers really said what they intended to say, or rather intended to say what they did say, the words must in this time have meant many things. The name, *i. e.*, the words hydrated peroxide of iron, is applied promiscuously in gas making literature to just 19 different substances, every one of which exists in nature or in art; and the proof of this is in the fact that sometimes they have written the formula—*i. e.*, the chemical equivalent—with the words. This confusion would matter little if it were not that the whole 19 are to be found in the gas works. Sometimes one, sometimes another, is made nearly pure; again, a half dozen are mixed together. These substances also differ amazingly in their absorption power, and I have heard a gas manager express surprise that his coal contained so much sulphur and that he had so soon to renew the charge in his boxes. The trouble was not in the coal as assay showed, but in the oxide, and a carefully made experiment showed that this oxide would exchange less than a single atomic weight of sulphur for the oxygen. The larger part, in other words, was not the proper stuff for the boxes at all.

As a rule, it is the worst of taste to import any theoretical chemistry into a paper like the Journal, and still worse is it to bring in technical questions and chemical formulæ; but it may be in this case the motive will be the justification. I wish to make clear, if I can, why the "oxide" differs so. We write $2Fe_2O_3 - 3H_2O$, or $2Fe_4O_6H_6O_3$, or $Fe_4O_3H_6O_6$, or $Fe_4O_36OH$, or $H_6Fe_4O_9$, or $Fe_4OH_6O_8$, each of which is an hydrated peroxide having distinct chemical existence, and a distinguishing physical form which is to be recognized without difficulty, if one is attentive.

Of these five are known to be found in the boxes, and are so very easily distinguished that in the yards the shovellers know them by sight, and will say that this one is "good oxide" and that is not. What their standard of goodness may be I do not know, but my standard would be absorbing 77 pounds of sulphur for every cwt. of oxide placed in the box; in other words, $Fe_4OH_6O_8$, in which the entire series $O_8$ is replaceable by sulphur.

An important question also is the position of the manufacturing plant in this work. Just what the influence may be which belongs to temperature and dampness in forming oxide I do not know, but that there is an influence of moment in each there is no doubt.

There are a vast number of ways advised for making the oxide, of which some will not make oxide which will give up more than one atom of O in exchange for S. In making oxide I have found one item which is added to illustrate the need of care. In the period of burning between the second and third "hosing," the temperature is very likely to run up very high, and the men are apt to use an excess of water, cooling it down too far so as to make a longer time before the next cooling, which treatment seriously injures the gas absorbing power. Indeed the amount of water pumped over the iron, the temperature the iron attains before the hosing, the length of time the hose is used for cooling the iron, the extent of the cooling, all affect the product, and the duty it will do; that is, the amount of sulphur the iron will exchange for oxygen.

Another thing which plays an important part is the extent to which the iron is divided. This question is one which I think any intelligent person can understand.

The surface presented by four small masses, each a mikron in diameter, is vastly greater than that presented by a single ball of four mikrons in diameter in proportion to the mass of Fe contained. In other words, the efficiency of the oxide is in exactly inverse ratio to the size of the pellets of iron. I have seen many cwt. of oxide made from wrought iron trimmings in which the surface was covered with rust, but the mass of the iron was iron still. On the other hand, I have seen an oxide which gave the same weight per cubic foot in which the most careful examination showed only a dust like the spores of a puff ball. Is there any need to explain why the dust-like oxide was better for gas purification than the one in great pieces?

The nuisance of burner stoppages, or, as it is now considered, iron carbonyl, is a direct dependent on the same fact. The pieces of iron, the unconverted helices of the wrought iron trimmings, are in just the condition to be converted easily into this much detested substance. For when the crude gas comes in contact with the oxide in the finishing boxes, instead of leaving the sulphur behind it and going on as it should, it loads up with the carbonyl, exchanging one "jag" for another as it were, making a nuisance of itself and an awful example of the gas manager.

Finally comes the question of plant. Is the gas house manager prepared to set up a plant to manufacture oxide? Has he any real idea of what his plant must be? To manufacture oxide that will stand the hurry and rush of daily life one must part the cast iron from the wrought, and the larger pieces from the smaller ones through the entire amount. This requires special machines and a steam engine to drive

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Sec. 52. Any member whose dues shall remain unpaid for a term of three years may be dropped from the roll of membership by a vote of the Council.

ALFRED E. FORSTALL, Secretary.

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| American Gas Light Journal | 125 | 25 |
| Auburn (N. Y.) Gas Light Company | 50 | 10 |
| Austin (Tex.) Gas Light and Coal Company | 50 | 10 |
| Barber, Chas. W | 10 | 2 |
| Blodget, C. W., Brooklyn, N. Y. | 50 | 10 |
| Binghamton (N. Y.) Gas Works | 50 | 10 |
| Buffalo City (N. Y.) Gas Company, " " Gas Light Company, " " Mutual Gas Light Co. | 500 | 100 |
| Clark, Walton, Phila., Pa | 600 | 120 |
| Cleveland (O.) Gas Light and Coke Company | 500 | 100 |
| Collins, C. R., Seattle, Wash | 10 | 2 |
| Columbus (O.) Gas Company | 125 | 25 |
| Connelly Iron Sponge and Governor Co., N.Y. | 50 | 10 |
| Consolidated Gas Company, of New Jersey | 100 | 20 |
| Crisfield, J. A. P., Savannah, Ga | 10 | 2 |
| Daniels, Jno. M | 25 | 5 |
| Derby (Conn.) Gas Light Company | 100 | 20 |
| Detroit (Mich.) City Gas Company | 200 | 40 |
| Dunbar, J. W., New Albany, Ind | 50 | 10 |
| Equitable Gas and Electric Co., Utica, N. Y. | 10 | 2 |
| Grand Rapids (Mich.) Gas Light Company | 125 | 25 |
| Griffin, Jno. J. & Co., Phila., Pa | 250 | 50 |
| Helme & McIlhenny, Phila., Pa | 250 | 50 |
| Humphreys & Glasgow, New York and London | 1,000 | 200 |
| Lawrence, W. F., Trenton, N. J | 25 | 5 |
| Love, Dr. E. G., New York | 50 | 10 |
| Maryland Meter & Mfg. Co., Baltimore | 250 | 50 |
| Miller, A. S., New York | 125 | 25 |
| Nettleton, C. H., Derby, Conn | 125 | 25 |
| Norwich (Conn.) Gas Light Company | 125 | 25 |
| Old, G | 25 | 5 |
| Roots, P. H. & F. M. Co., Connersville, Ind | 125 | 25 |
| Sherman, F. C., New Haven, Conn | 100 | 20 |
| St. Paul (Minn.) Gas Light Company | 125 | 25 |
| Turner, Thomas, Charleston, S. C | 20 | 4 |
| United Gas Improvement Company, Phila., Pa. | 5,000 | 1,000 |
| Vanderpool, Eugene, Newark, N. J | 500 | 100 |
| White, W. H., New York | 100 | 20 |
| Total | $12,010 | $2,402 |

NOTES.—Every indication is that the meeting at Niagara Falls this week, of the American Gas Light Association, will be a complete success. In any event, the officers and the committees have left nothing undone that should have been done to make the convention a notable one in the history of the Association's assemblies.——Superintendent F. H. Hess, of the new Mount Clemens (Mich.) Gas Company, has about completed the manufacturing plant, which he hopes to have in operation by the 1st prox. A feature of the generating apparatus (it is a 4-foot Lowe set) is that it can be operated either from the ground or from an upper floor.

[Communicated Article.]

## The Manufacture of "Oxide" in the Gas Works, from the Standpoint of the Man Outside.

By Dr. W. H. Birchmore.

About once in so often, be the time measured by days, weeks, months or years, the hard working, and almost invariably perfectly conscientious superintendent of the gas house, asks himself, "Does my duty to my employers require me to make my own oxide?"

It seems destined that this question must be asked; but how shall it be answered? Is it the duty of the gas works manager to make his own oxide, or shall he purchase from a manufacturer an oxide, so-called, of known power of purification, carefully prepared by skilled workmen under still more skilled supervision?

Probably this question has been more discussed and more written upon than any other relating to the details of gas making, but the discussion with living voice or pen and ink in every instance takes on a controversial tone. The men preparing the papers seem to feel chips upon their shoulders and, unconsciously of course, appear to be inviting some one to knock them off. This attitude is deplorable and has undoubtedly hindered the advancement of knowledge in reference to this important factor, and has been the cause of loss of revenue to the gas companies themselves as well as others.

Without paying any attention to the methods of making the product, the men who make their own oxide may be divided into two classes. Those who do it in spite of themselves, against their own will as it were, but urged so to do by their sense of what is due their employers; and those who do it for the sake of doing it, for the sake of trying some private notion, testing some theory or the like. Of those in the second class some are skilled men and competent chemists, some by a system of continuous endeavor have developed something of a special product, others knowing that the manufacture of the oxide is becoming more and more a specialized business seek to make it in order to convince themselves that they are "chemists," much after the train of reasoning indulged in by the "boy" in "A Scrap of Paper" to prove himself a man. On these men the fact that oxide making is regarded as a subject for special study by expert chemists acts as a lure, entices them to dangerous play, as matches children, and they fancy that can they but make oxide they will thereby place themselves among the said expert chemists. Thus convinced of their duty to make oxide they rush with a light heart and resounding tread into precincts which are hallowed if not holy, precincts which the experts enter with due sense of their own dignity and in white raiment.

This adds to the difficulty of obtaining a fitting interchange of views. The men who make for sale various grades of oxide are provoked at the incredulity of those who do not use their product and at the indifference of those who do. While the men who make their own oxide are unable to understand much of the views of the oxide makers, as, having so many other things to attend to, all the detail of oxide making is forgotten save the fact that it is made according to a certain formula, usually expressed in so many "wettings," and a certain proportion of iron to shavings.

In visiting various gas manufactories and sampling their oxide the first thing noticed is the wide variation among them. One is at a loss to say which is the more interesting, the difference in the oxide or the difference in the opinions about it.

The numerous materials, of course, insure great differences in the product; but this is lost sight of, and all alike are ready to declare that "oxide is oxide." In point of fact it is no such thing. Setting aside the differences arising from the use of the ferrous sulphate (copperas), "turnings," "borings," either cast or wrought, and the question of an oxidation process whose first term is sulphur action as opposed to chlorine, or the mixed reactions, which certainly are variable enough, there remain the differences in texture which are so important in practice.

Why will some samples of oxide replace eight oxygen atoms by sulphur and others only two? Why are some samples for ever getting hot and others never? (The explanations given really explain nothing.) And why do some samples revivify so well and so easily, while others will not do so at all. Besides these differences, which any one can see, are others which show themselves only to the men in white raiment, but which are not beyond discussion here.

Let us first of all understand what we mean when we say hydrated peroxide of iron. To determine this I have examined the literature bearing on the subject for the last 25 years, and in doing so I have found beyond all doubt that if the writers really said what they intended to say, or rather intended to say what they did say, the words must in this time have meant many things. The name, *i. e.*, the words hydrated peroxide of iron, is applied promiscuously in gas making literature to just 19 different substances, every one of which exists in nature or in art; and the proof of this is in the fact that sometimes they have written the formula—*i. e.*, the chemical equivalent—with the words. This confusion would matter little if it were not that the whole 19 are to be found in the gas works. Sometimes one, sometimes another, is made nearly pure; again, a half dozen are mixed together. These substances also differ amazingly in their absorption power, and I have heard a gas manager express surprise that his coal contained so much sulphur and that he had so soon to renew the charge in his boxes. The trouble was not in the coal as assay showed, but in the oxide, and a carefully made experiment showed that this oxide would exchange less than a single atomic weight of sulphur for the oxygen. The larger part, in other words, was not the proper stuff for the boxes at all.

As a rule, it is the worst of taste to import any theoretical chemistry into a paper like the Journal, and still worse is it to bring in technical questions and chemical formulæ; but it may be in this case the motive will be the justification. I wish to make clear, if I can, why the "oxide" differs so. We write $2Fe_2O_3 - 3H_2O$, or $2Fe_4O_6H_6O_3$, or $Fe_4O_3H_6O_6$, or $Fe_2O_260H$, or $H_6Fe_2O_6$, or $Fe_6OH_6O_6$, each of which is an hydrated peroxide having distinct chemical existence, and a distinguishing physical form which is to be recognized without difficulty, if one is attentive.

Of these five are known to be found in the boxes, and are so very easily distinguished that in the yards the shovellers know them by sight, and will say that this one is "good oxide" and that is not. What their standard of goodness may be I do not know, but my standard would be absorbing 77 pounds of sulphur for every cwt. of oxide placed in the box; in other words, $Fe_4OH_6O_6$, in which the entire series $O_6$ is replaceable by sulphur.

An important question also is the position of the manufacturing plant in this work. Just what the influence may be which belongs to temperature and dampness in forming oxide I do not know, but that there is an influence of moment in each there is no doubt.

There are a vast number of ways advised for making the oxide, of which some will not make oxide which will give up more than one atom of O in exchange for S. In making oxide I have found one item which is added to illustrate the need of care. In the period of burning between the second and third "hosing," the temperature is very likely to run up very high, and the men are apt to use an excess of water, cooling it down too far so as to make a longer time before the next cooling, which treatment seriously injures the gas absorbing power. Indeed the amount of water pumped over the iron, the temperature the iron attains before the hosing, the length of time the hose is used for cooling the iron, the extent of the cooling, all affect the product, and the duty it will do; that is, the amount of sulphur the iron will exchange for oxygen.

Another thing which plays an important part is the extent to which the iron is divided. This question is one which I think any intelligent person can understand.

The surface presented by four small masses, each a mikron in diameter, is vastly greater than that presented by a single ball of four mikrons in diameter in proportion to the mass of Fe contained. In other words, the efficiency of the oxide is in exactly inverse ratio to the size of the pellets of iron. I have seen many cwt. of oxide made from wrought iron trimmings in which the surface was covered with rust, but the mass of the iron was iron still. On the other hand, I have seen an oxide which gave the same weight per cubic foot in which the most careful examination showed only a dust like the spores of a puff ball. Is there any need to explain why the dust-like oxide was better for gas purification than the one in great pieces?

The nuisance of burner stoppages, or, as it is now considered, iron carbonyl, is a direct dependent on the same fact. The pieces of iron, the unconverted helices of the wrought iron trimmings, are in just the condition to be converted easily into this much detested substance. For when the crude gas comes in contact with the oxide in the finishing boxes, instead of leaving the sulphur behind it and going on as it should, it loads up with the carbonyl, exchanging one "jag" for another as it were, making a nuisance of itself and an awful example of the gas manager.

Finally comes the question of plant. Is the gas house manager prepared to set up a plant to manufacture oxide? Has he any real idea of what his plant must be? To manufacture oxide that will stand the hurry and rush of daily life one must part the cast iron from the wrought, and the larger pieces from the smaller ones through the entire amount. This requires special machines and a steam engine to drive

them. The difference between the hand mixed and the machine mixed product is so great that one seeing the two side by side for the first time would have difficulty in believing them intended for the same thing. One can go still further and affirm that, in the nature of the case, a hand mixed oxide must be less well mixed and less efficient than a comparatively poor machine mixed article.

To pay the interest on the cost of such a plant and its operation requires the handling of at least 5,000 bushels per day. How many yards in this United States give any such yield as this? Yet in the manufactories this is the rule, and equality of product is to be obtained only by such size of product.

I have already referred to the duty of 77 pounds of sulphur removed per cwt. of oxide as the highest duty consistent with revivification; but how many makers dare promise it? One may safely say very few indeed, if any; yet this may be approached. There is no reason why, with the persistent experimentation in the factories, their chemists should not succeed in making an oxide in which the sulphur should substitute for at least four, possibly more, of the possible eight removable oxygen atoms. The oxide user has benefited by the specialization of the oxide trade, now let him keep a more accurate account of the results.

It is only in this way he can get at the value of the oxide. This value is the number of pounds of sulphur removed per number of pounds of oxide used. If the cwt. oxide carries 66 pounds of sulphur, then its duty is ⅔ of what it should be. It is all nonsense to say the boxes have cleaned so many cubic feet of gas unless the sulphur content is given, and even then the real time for assay is after the material taken from the boxes has been mixed, sampled and mixed again. And this because in some boxes I have seen the oxide quite exhausted in one part of the box and far from exhausted in another, while the assay of the samples from the boxes showed that the exhausted portions were still as active as possible.

It is noticed in a year's travel that the men who make their own oxide are always the men who have the most trouble with the coal, and are continually telling how often they have to change, revivify or renew their oxide boxes. Why they do not suspect the oxide I do not see. The assay of their coal for sulphur always shows a tolerable impurity, and an assay of their oxide always shows it a little or a great deal inferior in its absorbing power to the average factory made. Would it not be well for these men to go a step further and begin an assay of their crude product? I am told that the gas companies will not pay the wages of chemists. I should hope no *chemist* would consent to do the work, which belongs to the most elementary routine analysis. Let the superintendent provide the needed apparatus which costs but a trifle Some chemical supply men will furnish it for $6; and any intelligent office boy will do the work as exactly as the man on $10 a day, and better, for he will ask no questions of Dame Nature. If once in two weeks the superientendent makes a test run—time required, 15 minutes—it is sufficient.

In this way easily, and in this way only, can the superintendent keep any check on the actual duty done per cwt. of oxide, and doing this he can quickly satisfy himself that he must make a good oxide to keep up with the market—a very good oxide indeed.

For the oxide maker at the works whose circumstances actually do compel him to make his own material, and to make it well, for, all things considered, some do make it astonishingly well (curiously enough it never seems to occur to these men that *they are chemists* in fact if not in name), one can have nothing but praise, regretting at the same time that he does nothing to advance the knowledge of the world at large. If he would only note the temperature of his working heaps and of his boxes and a few items of similar importance he would obtain data of infinite value to the gas trade. By gathering up these data he could bring up the information to a higher plane, and this elevation might be of interest to him in the shape of an increased salary.

But with him of the light heart and clanking heel no such sympathy is possible; one wonders why he is tolerated among the skilled men at all. Certainly it will not be for long. A generation of younger men who do not aspire to be called "chemists," but who are good business men, are taking hold of the tiller; these guided by men who deserve the title of "skilled in the art which none may name," for if they have not studied in Egypt they are skilled in the Egyptian learning, will soon introduce into gas houses, as elsewhere, the system of stopping the smallest leak in order to save the mills which grow to cents and dollars and pay big dividends.

The value of the waste material counts, and the market for it is slowly but surely growing, and in this fact is found the doom of every superintendent whose belief is, "Oh, any one can make oxide;" and whose method is, "Heh, Mike! Turn this stuff over, when you have time."

Truly a "little knowledge" is a dangerous thing in the gas business, particularly just about now.

[Prepared for the JOURNAL.]

## Subjects for Association Papers.

By MR. F. H. SHELTON.

In some comments upon the papers that have been read before the American and Western Gas Associations, in an article in the issue of the JOURNAL for September 12th, the writer made the assertion that many subjects had never been written upon; that many had been written upon, but incompletely; that others written upon had not been brought down to date, and that as bearing out such assertion a list of upwards of 40 topics would be shortly offered by him. Such list is herewith subjoined. The topics are listed quite haphazard as they have occurred and been jotted down. While possibly a few of them have been covered in the papers of the minor Associations, it is felt that the great majority will be recognized as coming within the assertion and category above, and as ones that could be written upon to the advantage of the membership of the several Associations.

*Station Meters.*—It is curious that in the 25 years of the two major Associations there has never been a paper on this topic. Will some meter maker supply one, covering the proper original setting of a station meter? Also the care of such. Also the testing of station meters. Also the various types. Why has a meter of to-day 50 per cent. more capacity than one 15 years' old? What is the difference in registration of an overworked meter? What are the results with intermittent water gas at varying pressures?

*Consumers' Meters.*—What constitutes a good meter? Where are meters cheapened? What should a gas man look for in comparing makes? How many really know!

*Testing Consumers' Meters.*—A brief compendium of instructions would be helpful to more than one superintendent who personally knows how, but has to delegate the work to new men.

*Exhausters.*—A review of the Mackenzie, the Root, the Wilbraham and other forms that have appeared on the American market would have historic value, the differences being impartially noted. What constitutes a superior exhauster? What of the care of exhausters? There has never been an exhauster paper before the two Associations in question.

*Gas Oils.*—A paper on the simple testing of such is greatly needed. How many superintendents can tell whether oil received is what it should be before it is used and bad results appear?

*Gasholder Design.*—Some gas men buy a holder because a works across country has a similar one that so far has worked all right, and because the man that is selling it says it is all right. How many *know* that it is all right as to weight of metal in columns, framing, tank, shell, etc. The working out of the strains of a medium size holder, with the whys and wherefores lucidly set forth, would constitute a most instructive paper to the *average* gas man. Such a paper should also tell where a holder can be "skinned" and cheapened, and the principal structural comparisons that should be made in comparing bids.

*Gasholder Foundations.*—This item is supplied by the gas company. A paper on proper foundations would be timely in this day of steel tanks.

*Roofs for Gas Works.*—Perhaps a minor topic, yet one that could be intelligently written upon to advantage in connection with retort, generator and purifying houses. The relative advantages and costs of various kinds.

*The Water Supply of Gas Works.*—Covering proper amount per 1,000, and the relative costs of city supply vs. artesian wells at various prices. Also, analysis and effect on boilers. Also, circulation systems, using water over and over again.

*Gas Mains under Water.*—Telling those who have never laid such the various ways of doing it under varying conditions, the cost, how to go about it, etc.

*Gas Mains over Bridges.*—A concise, illustrated paper on bridge work, simple trusses of various spans and designs, and on coverings for exposed pipes would be very convenient.

*Street Main Governors.*—No paper has appeared on this subject since one 15 years or so ago. Under what conditions should they be used at works? Also, on outlying mains or holders? What forms have been used in the United States? What of their care?

*The Transmission of Gas Considerable Distances.*—Under what conditions is it best to push the gas or to pull it? Exhausters versus

rotary fan blowers for such work. The question of consumers' pressure along the route.

*Insurance.*—The conditions that make such desirable on gas works. The amount, nature and cost of it.

*The Police or Regulating Power of Cities in Street Work.*—A paper on the relation of gas companies to cities in such connection.

*Fifty Cent Gas.*—A review of the Kansas City fight, and other similar cases, with the lessons and results thereof to both the public and the gas companies, with the arguments for and against gas at such prices.

*Trays for Purifiers.*—What is the best form of tray for each of the principal oxides used, and why?

*Gas Stoves: What is a Good One?*—Stoves are bought for a good many other reasons than definite knowledge as to best design. What *is* the best design and construction of typical stoves? Can a stove be built having each advantage claimed by each one of 20 makers for his pattern?

*The Conduct of Gas Appliance Exchanges.*—A good topic in these days wherein the business end needs more push than the works.

*Practical Notes on the Daily Operation of a Water Gas Apparatus.*—Such notes on "retort house practice" are a plenty. How few there are on water gas.

*Practical Notes on the Construction of Water Gas Apparatus.*—Linings, shell work, grates, checker brick, size of air and steam supplies, stack outlet, oil heaters, etc., etc. There have been plenty of papers on construction details of benches, and almost none on water gas machinery.

*Free Piping.*—An argument justifying gas companies in giving such to get new business, with facts, figures and some results.

*Gas House-Heaters.*—A review of the efforts and experiments made to evolve a gas heater to replace cellar furnaces. Stumbling blocks, progress made and the probability of success. A most important subject, that will yet be solved, the writer thinks.

*Acetylene.*—A review of what has been commercially accomplished by it since its introduction. Its present field and status and its probable future, based on carbide made in continuous furnaces, with horse power 85 per cent. of the cost, at $8 per electrical horse power per annum at Sault St. Marie.

*Newspaper and other Advertising.*—A subject new to Gas Associations.

*The Return of Street Lighting through the Medium of Welsbach Lamp Posts.*—How extensively is this being accomplished, and the prospects and desirability?

*Franchises.*—A discussion of a proper form of franchise, fair to a company and the city, touching on conditions, terms, bonuses, etc.

*A Tabulated, Authentic, Convenient Table of Costs of Light from Commercial Sources.*—Hardly a paper; but the compilation of costs of gas, Welsbach, electric, oil and acetylene lighting would be convenient and notes thereon interesting.

*Distributing Gas at High Pressure.*—Natural gas is brought from the fields at 100 pounds pressure or more. It is safely distributed in scores of places at several pounds pressure. Yet artificial gas men still stick to distributing their product at but $\frac{1}{12}$, $\frac{1}{8}$, $\frac{1}{4}$ or $\frac{1}{2}$ of 1 pound Why should not the capacity of mains be doubled or quadrupled by working at several pounds pressure? Would it not figure cheaper to use house governors or regulators than to put in big, new mains? What real reason exists to prevent the cheap and successful working with artificial gas on such lines as well as natural gas? To the writer's mind this is coming, and presents a capital subject for a paper of great interest and importance, if well gone into.

*Gas Distribution without Leakage.*—For 40 or 50 years leakage has existed. Is it to always? Are absolutely tight pipes and joints impossible? Is not a stout pipe with *flexible* joints, durable and gas tight, yielding to ground disturbances, the truer plan to work on than the present one of a practically brittle main with rigid joints so universally used. A discussion of this, with proposed joints past and present, would be to the writer's mind second to none.

*The Legal Liability of Gas Companies to the Public, in Case of Accident, likewise to their Employees.*—This side of the law is rarely touched upon in Association papers. Yet it could and should be; and a paper on each of the divisions in the above topic, reviewing general laws, condensing and applying same, would not be amiss to a gas man.

*Taxation.*—Typical practice; just versus unjust; practice in various States and communities. A general review that would assist a manager in resisting unjust assessments.

*House Governors.*—Types, cost and the various plans of placing them; also an argument justifying a gas company in installing them free, as a matter of policy.

*Gas Works as a Nuisance.*—The avoidance of smell, noise, smoke, drainage, etc., and the legal liability for same. General principles and how to avoid trouble by modern construction.

*The Location of a New Gas Works.*—The relative bearing of the questions of convenience, pressure, railroad facilities, water, drainage, nuisance, land value, etc., etc.

*Elevators.*—A minor topic rarely mentioned. The costs and advantages of hydraulic, power hoist, steam hydraulic and other forms of elevators for gas works.

*Best, Various or New Methods for Heating Outlying Holders.*

*Sub-Agencies for Collection of Gas Bills.*—To what extent is it desirable to go in this direction. Results, costs and examples of this arrangement.

*Proper Capitalization of Gas Companies.*—Wide variations in this respect afford room for a discussion of the subject, which is one that is often up nowadays, and which has not been written upon for a long time.

*A Justification of Paper Writing by Supply Men on the Articles They Sell.*—Criticism has been made that it is improper for a supply man in a paper to write up his own wares. The writer believes that the Associations suffer in holding to such policy. The man who has worked out an article, apparatus or scheme usually has studied the subject much more than his hearers have, and can instruct them on it. Undue praise on his part is rarely given owing to his understood interest in it. If it is, it is discounted and hurts more than it benefits. The supply men are experts in their particular lines, and to the writer's mind should be urged to write much more than they do. A paper on this subject there is room for, in view of the fact that the present paper system is unsatisfactory, that the cry is that writers are hard to get, and that a minor percentage of the engineers write the bulk of the papers and supply men very few.

*City Gas Inspectors.*—Numerous cities have them. A paper would be desirable reviewing their use, desirability or otherwise, and their record of efficiency or non-efficiency as shown by facts and results in existing instances. Where inspectors are proposed—often their expense being saddled on the gas company—such information would be helpful.

The above list it will be noted is varied as to topics. Yet the writer doubts that the desirability of papers thereon can be gainsaid. It may be said that many of the topics named would involve considerable research and work on the part of the writer. So much the better. To just such extent would the information finally given be the more valuable. The best writers and the sincerest workers for the good of Associations enjoy, rather than otherwise, digging in and getting at the root of things, and it is the result of such labors that is most educative to the membership and a prime object of the Associations.

[Continued from page 530.]

## Coke Making for Profit—No. II.

By Mr. Fred C. Keighley, in *Am. Mfr.*

I am of the opinion that one of the mysterious causes of some coke ovens falling down so quickly after being built is unquestionably the result of excessive tamping by careless men. I believe that the whole of the filling between the ovens and over the crown should be made of infusible material, excepting the top layer of two feet, which should be regarded more as an excluder of moisture than a jacket to retain heat. Too thick a covering of non-conducting material on the top of the oven crown is a source of injury to the brickwork, causing the brick to run and spall excessively. Stiff yellow clay will probably be the best material to use for this purpose, providing that it does not contain too much iron or lime. The linings of the ovens should be carried up perpendicularly for 12 courses; then the crown should be started and built to a sweep.

The height of the crown above the lining is a much disputed question among coke men—some being in favor of a high crown, and others in favor of a low crown; and the height of the crowns vary in accordance with these opinions, being built to a height of 4 to 6 feet above the lining to the under side of the ring or trunnel. The height of the crown of the coke oven depends very greatly upon the character of the coal coked; therefore, no rule can be given, and the projector of a plant must study the requirements and adjust his crown dimensions to suit them. The block ovens should be built upon the same lines as the bank ovens, excepting that in the block ovens, ring walls would likely have to be built from the solid ground up through the filling for the oven seats.

The grades for both coke ovens and railroad sidings should always be in favor of the loads, if possible, and the grades of each should be as nearly alike as practicable; and such grades are best when they are about 1 per cent., or 1 foot in the 100-foot length, in favor of the load.

Favorable grades cannot always be obtained, and when such is the case the railroad sidings must have the first consideration; for grades on the ovens can be more easily overcome than grades on the sidings, although it is, as before remarked, always best to have both oven and railroad grades nearly uniform and conformable to each other, if the expense of getting them so be not too great.

The best width for a coke yard, or wharf, seems to be 30 feet, with a fall of 1 foot in that distance, towards the railroad tracks. The height of the yard depends entirely upon the kind of trade that is being supplied. If foundry, select and hand-picked coke is to be the regular business, then the yard wall should be on a level with the floor of the railroad cars. Where open-top cars are loaded, the yard wall should be higher and the ovens should be built sufficiently high to keep down the wheel up on to the cars to not more than a grade of 1 foot in 10, or the wheel will be very laborious to the coke drawer. The yard should be filled in with at least two feet of coke ashes in order to make a dry yard. The under filling may be of any convenient filling, excepting waste coal. The yard water lines should be of 4-inch cast iron bowl pipe, laid in a 2-foot ditch—these lines should be cased all over and under with a heavy filling of good, stiff, yellow clay, or they will be eaten up by the acid water from the coke ovens. Specifications for coke ovens and yards will be given in a later chapter.

*The Equipment of a* 300 *Oven Plant.*—One saddle tank locomotive, light weight, four wheels, 7 by 12 cylinders; three double side chute larries, 200 bushel capacity; one dirt truck; 75 coke barrows; 75 sets of hose and pipe; 75 long coke scrapers; 75 short scrapers; 300 tunnel head dampers; 60 damper hooks; 3 horses and harness; 3 ash carts; 3 coal shovels; 60 running planks; 60 car planks; 6 mud barrows; 6 canal shovels.

At plants loading foundry coke, or all box cars, 60 wooden chutes will be needed if the coke yards are high, in place of the running plank and car plank. These chutes are made of hemlock or other suitable boards, and of the size of the car door, and to reach from the yard to the bottom of the car.

Some plants have the coke yards or wharfs built so as to be on a level with or slightly above the floor of a box car. In that case, the coke is wheeled directly into the car and forked back by the forker.

Where open-top cars are loaded, the railroad cars are generally reached by what is termed a "run." This run formerly consisted of a pair of trestles and three planks, and was stationary; but of late years, a single plank 3 inches thick, 20 inches wide, and 20 feet long is used, which answers every purpose, is much better, cheaper, and more convenient, as it can be easily moved from point to point and leaves the yard clear of the unsightly trestles, etc. In both cases, a short plank is used to bridge the car.

The locomotive is not used at all coke works for hauling the larries to and from the coke ovens. Some few small operators still cling to the old plan of charging by mules or horses, and in many cases, some form of wire rope haulage is used for this purpose. The locomotive seems to be the most convenient, expeditious and economical, so far as relates to the operation of charging; but I am very much afraid that the locomotive is the cause of excessive repair bills in coke oven operation, as coke ovens are now built. However, this matter will be discussed more fully in other chapters.

*Working Force for* 300 *Ovens.—Day Men.*—One locomotive engineer; 2 chargers; 1 track man; 1 yard boss; 1 car shifter; 2 track cleaners, or laborers; 3 ash carters; 1 car inspector, where individual cars are used; 1 superintendent, for coke plant and mine jointly.

*Contract Work.*—Seventy-five coke drawers; 6 levelers; car forkers where coke is forked; masons, when coke ovens are to be repaired. Coke forkers are not much needed where open-top cars are loaded, but when foundry coke is made and box cars are loaded forking is quite a serious item—in some cases amounting to as much as 10 cents per ton. This kind of work is generally paid for by the oven or car. Wage scales will be given later.

*Firing Up a New Plant of* 12*-Foot Ovens.*—The ovens at a new plant should be dried out before they are charged. The work of drying out should be carried on very slowly and carefully, especially so, if the erection of the ovens were carried on during stormy or wet weather. Drying out is generally done by lighting a small wood fire in each oven, and gradually increasing the fire by adding lump coal from time to time. A much more economical plan is to dry out thoroughly about 12 ovens and commence to make coke in them to be used as fuel in drying out the other ovens. In a plant of 300 ovens, laid out in three rows of 100 ovens each, four ovens could be dried out in each row. Then the coke made in them could be distributed with a minimum haul. To dry out or fire ovens with coke, the coke should be divided into piles of about one ton each, at different points along the yard, with a view to having each pile of coke conveniently supply a certain number of ovens. These piles are to be set on fire, and as soon as the coke is heated to a bright red or almost white heat, two or three forks are placed in each oven and a few bushels of good lump coal (not too large) piled over it. Sometimes a little wood is used, but it is not at all necessary if the coke be hot enough, and the handling and piling be skillfully done. These fires will have to be replenished from time to time, and a man should be detailed to look after them during the day and another man at night, until the ovens are not only thoroughly dried out, but warm all over.

In from a week to 10 days, unless in very wet weather, the ovens can be thoroughly dried and made ready for the first charge. I think it is very short-sighted policy to dry out ovens too fast in order to save a few dollars in the way of labor, for one oven spoiled will amount to more than the cost of labor for drying out the whole plant. After the ovens are thoroughly dried out, they may then be fired with a light charge of coal, say 100 bushels. The ovens are fired alternately; that is, fire an oven and skip one, until half the number desired to be put in operation is reached, and the next day the others are fired.

In lighting up the first charge, a few forks of hot coke are thrown into the front of the oven, and the lumps of coal from the charge just put in are piled over and immediately back of the hot coke, and on these a barrowful of soft coke is laid. The fine coal of the charge is then pulled forward with a coke scraper, in such a manner as to reinforce the lump coal and coke. The oven door is then tightly built up, with the exception of a hole about 1 foot square near the bottom, which is left for an air hole, and to allow the introduction of the poker from time to time, to keep the fire in proper condition, and the ring, or trunnel head, is uncovered.

The oven should be thoroughly cleaned out; that is, all loam, brick and ashes from the drying out fires should be removed before the charge is put in. The first charge should be, as stated before, 100 bushels; and if the drying out and firing up have been properly done, the charge should be "off" or "around" within two, not more than three days. The first charge will not be first-class coke, and ought to be sold or shipped as soft or "off" coke. It is generally carried off to the ash pile, or reserved for use in firing up ovens at some future time.

The first charge should always be drawn while hot, and the coke should be watered outside of the oven, in order that the oven may have a chance to accumulate heat—there is nothing gained by watering the first charge in the oven, for the coke is naturally dark and spongy. The second charge should be heavier, say 115 bushels. The lumps of coal should be as before and some hot coke thrown into the oven, the lumps of coal being put on top, and on the back of this, as a precautionary measure. The charge may be leveled this time, which is not always done in the first charge. The second charge should "come off," or be ready to "draw," within 48 hours. Water should be used very sparingly and carefully in cooling down the coke in the oven, for the oven will still not have attained its full working heat, and it is better to spoil a little coke than chill the oven. I would consider it good practice to draw the second charge hot and water outside. The coke from the second charge should be a fair article, but it will not be first-class, no matter how skillfully the work is done, and it may be sold as "off" coke, or stocked on the yard and mixed with the coke of later charges as it is loaded.

The third charge should be self-igniting; that is, the oven by this time should have accumulated enough heat from the former charges to make the introduction of hot coke unnecessary, and the charge itself may range from 120 to 130 bushels. The coke from the third charge should be a pretty fair article, and may be loaded as blast furnace coke. This third charge should be "around" in 48 hours, prompt. After the third charge the plant may be run on the regular 48-hour and 72-hour basis; that is, 48-hour charges four days in the week, viz., Monday, Tuesday, Wednesday and Thursday, and on Friday and Saturday, 72-hour charges. If trade is not good, 72, 96 and 120-hour coke may become a necessity. Of course, the condition of the coke trade and of the mine supplying the coal will to a great extent determine how the ovens are to be run, and what kind of coke is to be made.

Of late years a great deal of the soft coke and "off" coke unavoidably made from time to time at beehive plants, is used for fuel purposes about the plant, and more or less of it is now sold for heating purposes about the cities. So that, what at one time was a source of trouble

and loss, is actually developing a trade of its own; and some day fuel coke (I do not now refer to crushed coke) will undoubtedly be a trade worth working for. Blast furnace people will then be better satisfied than they have been in the past.

[To be Continued.]

## A Few Hints on Carbonization.[1]

By Mr. S. Carpenter, of East Ham.

In offering to students and young gas managers who have just entered the gas profession, a few hints on carbonization, the writer's advice first would be this: Look well to the heats of the retorts, and keep them at a bright red. Do not have them at a too high heat, as it will be detrimental to the illuminating power of the gas, and stop up the ascension pipes. The retorts must be kept at a bright red heat, so as to well carbonize the coal, and keep sufficient vacuum on the hydraulic main, to take away the gas as quickly as possible, so that there may not be any undue pressure on the retorts, as this would cause them to scurf, and obstruct the ascension pipes. Have pressure gauges on all the outlets of all the apparatus through which the gas passes; and if possible, bring them all into a room, fix them side by side, and keep them in good working order, as they are the key of the works. If at any time there should be a stoppage, the gauges will indicate its locality.

For the benefit of those who may not have had an opportunity of testing coal for the quantity and quality of the gas distilled from it, the writer ventures to offer a few remarks. Those who have analyzed coal know well what it is composed of, but the writer has often been asked the question. Coal is often spoken of very slightingly, but it is a very important factor in manufacture in general. It is composed of the following ingredients: Carbon, hydrogen, nitrogen, oxygen, sulphur and iron. By putting the coal into a retort at a bright red heat, its normal condition will be disturbed. During its distillation, the coal yields coke, carbureted hydrogen, hydrogen, ammonia, bisulphuret of iron, and various basic hydrocarbons, photo-sulphuret of iron, tar and water. Casting a glance at the composition of coal, we shall see at once the origin of the various products obtained by distillation at a bright red heat. Thus we are able, in a tabular form, to observe the original and subsequent order of arrangement, which takes place on disturbing the normal condition of the coal. After all the volatile matter has been driven out of the coal in the retort, the excess of carbon remains as coke, which holds the protosulphuret of iron driven off from the decomposition of the bisulphuret contained in the coal. Part of the hydrogen remains free; part combines with carbon, giving rise to various kinds of hydrocarbon, such as gas, naphtha and tar; while another part combines, with some of the sulphur of the bisulphuret of iron and any free sulphur present in the coals to form sulphureted hydrogen. The rest unites with oxygen to form water, or with nitrogen to produce ammonia; the remainder of the oxygen being taken up by part of the carbon, generating carbonic oxide and carbonic acid.

It has been said that the formation of bisulphide of carbon is altogether a secondary action. But the writer has not found it so. It is produced in the first hours of the distillation of the charge of coal, but in very small quantity. It is in the last hours when the generation of volatile matter begins to lessen, and the coke commences to form, that the bisulphide of carbon increases. At this stage of the distillation the bisulphide of carbon is given off from the newly formed coke, which holds the protosulphuret of iron derived from the decomposition of the bisulphide. After expelling the volatile constituents of the coal, if the heat is still made to act upon the residual coke, the bisulphide of carbon makes its appearance very freely. If the original dip pipes are used, and a good tar seal is kept up in the hydraulic main, a portion of the bisulphide of carbon will be retained in the tar. Bisulphide of carbon is a sulphur acid, and as much of it as possible should be removed from the gas. As coal gas is so generally used for illuminating purposes, it should be made as pure as possible.

The impurities which are present in crude gas, and require removal, are ammonia ($NH_3$) carbonic acid ($CO_2$), sulphureted hydrogen ($SH_2$), and bisulphide of carbon ($CS_2$). They are not only useless but injurious, and it is very important that they should be taken out of the gas. Carbonic acid is incapable of supporting combustion or life. Hence it is not only useless, but exceedingly deleterious to the illuminating power of gas, and very hurtful to animal life, even when largely diluted with air. Bisulphide of carbon is a sulphur acid. The sulphur in gas is a pernicious thing, because it forms sulphurous acid by taking oxygen from the air when burning. It is therefore necessary to use lime for eliminating all the carbonic acid and part of the bisulphide of carbon. As to the sulphur compounds in the so-called bisulphide of carbon, their entire removal is undoubtedly one of the most important problems in connection with the purification of coal gas; and though considerable progress has been made in this respect during the past few years, there is not anything known at present that will take it out entirely. It is a sulphur acid, and hydrogenated sulphide of calcium is the only agent that will remove a part of it. This material is produced in the following way: There should be two purifiers charged with hydrate of lime. When the crude gas is turned into the lime purifiers, the material in the first vessel will eliminate from the gas all the carbonic acid, and part of the sulphureted hydrogen, and the remainder will pass on to the second purifier, where the lime is converted into what the writer terms hydrogenated sulphide of calcium, which at the present time is the best known agent for absorbing bisulphide of carbon. There must be sufficient sulphureted hydrogen left in the gas which passes on to the second lime purifier to keep the lime in this particular condition.

In the management of retorts, whether they are of iron or clay, it is of the utmost importance that the interior should be kept as free as possible from carbon incrustation, as, in addition to occupying space that should be available for the coal, it presents a non-conducting substance, which obstructs the passage of the heat from the furnace to the coals undergoing carbonization. This not only increases the expense of the fuel for the furnace and for labor, but offers great facilities for the destruction of the retorts. The gas should be drawn from the hydraulic main as quickly as possible, so as not to subject it to back pressure, which brings about a deposit of carbon to the same extent as would a very high temperature without pressure. The back pressure on high heats would cause the splitting up of condensible hydrocarbons into non-illuminants, which would have the effect of not only reducing the quantity of gas obtained, but also of lowering the illuminating power of the gas, causing a deposit of carbon on the interior surface of the retort, and obstructing the ascension pipes. It is equally necessary that the light-giving power of the gas should not be destroyed by using too high heats, or the quantity of the gas reduced by slow distillation. In the carbonization of coal, the greatest care should be taken not to have the heats either too high or too low. The former would require the use of cannel to compensate for the loss of luminosity in the gas; with the latter there would be more tar and less gas, as well as soft coke, which is not profitable. The retorts should be kept at a bright red heat during the carbonization of the coals. For the greater part of the time the charge of coal is burning off, it remains without any elevation of temperature. Shortly after the coal is put into the retort and the lid closed, it commences to intumesce, and, delivering the gas, carries off the heat communicated from the furnace to the retort and then to the coal. The action is very similar to that of an ordinary kettle when the water is boiling. It delivers the heat absorbed by the water in the form of steam, which issues from the spout. Thus it is only when nearly all the volatile constituents or useful gases are passed off from the coal that the temperature of the mass of carbon increases. After the coke begins to form, and all the little pores which have served as passages for the egress of the gas during the carbonization process close, then the heat rises.

In the carbonization of coal, care should be taken that the retorts are not overcharged. If they are filled too full, there will not be sufficient room for the coal to swell. If it touches the crown of the retort, it causes incrustation. A dense black fluid is formed at the moment of placing the lid of the retort on, which is nothing more than the volatile properties of the coal passing off as gas, tar and other products—such as ammonia, hydrocarbons and other constituents. Another precaution to be observed is to draw the coke as soon as it becomes incandescent. By retaining it in the retort after all the useful gas is given off, other gases are delivered, though in small quantities, which deteriorate materially that first obtained; and from these arise the sulphur compounds other than sulphureted hydrogen which cause so much trouble. Bisulphide of carbon is generated principally in this way. If the heat is allowed to act upon the residual coke, the bisulphide will be given off, as the coke holds the protosulphuret of iron resulting from the decomposition of the bisulphide in the coal. The sulphur from the coke combines with sufficient carbon to form bisulphide of carbon.

By storing or passing through cold pipes, gas loses in illuminating power, owing, no doubt, to the condensation of naphthaline ($C_{10}H_8$), benzol ($C_6H_6$), and allied or derived substances. Moreover, as olefiant gas ($C_2H_4$) is soluble in water, this constituent, which is very serviceable for lighting purposes, is also diminished by storing the gas. It will now be understood why the gas has to be of higher illuminating

1. From the *Journal of Gas Lighting*.

power in the winter than in the summer. The relative proportions of permanent gas and condensible solids and liquids, as well as the chemical nature of these products, depend on the temperature employed in carbonizing the coal, and the length of time the material is exposed to the action of heat. The lower the temperature, and the more quickly the operation is carried out, the greater is the proportion of solid and liquid products, and *vice versa*. The reason for this is that more complex substances generally split up into simpler ones on exposure to heat; and the higher the temperature, the simpler the product. Thus, olefiant gas ($C_2H_4$) will split up into light carbureted hydrogen; and the coke will give off sulphur, which will combine with carbon and give rise to bisulphide of carbon. Though it is the chief object of the distillation of coal to get a large yield of permanent gas, it is equally necessary that the illuminating value of that gas should not be destroyed by using too high a heat, and that an undue proportion of tar should not be produced by employing too slow a distillation, which is not profitable.

In carbonizing coal, do not separate the gas from the tar in the hydraulic main. Let both pass together to the condensers; and in the passage to and through these vessels the tar will take out of the gas some of its impurities before it reaches the scrubbers and purifiers. Good condensation helps greatly in the purification of coal gas. Anti-dips are scarcely of any good to a gas manager, and for this reason: The gas as it is made is passed directly away, without mixing with the tar when it is of high temperature in the hydraulic main. As the tar, as already remarked, is a purifying agent, the gas ought not to be separated from it in the hydraulic main. On examining the nature of tar, we see that it is composed of certain solid properties, such as carbon, naphthaline, etc.; while there are gaseous properties, such as hydrogen, carbureted hydrogen, carbonic acid, sulphide of carbon, etc. The writer nevertheless thinks that tar can certainly be treated as a purifying agent; for without it, or some similarly constituted substance, the purification of coal gas would be a failure. If there were not amalgamation of so many of the properties which crude gas contains as it passes into the hydraulic main, it would be almost impossible to rid it of its impurities. As the gas rises from the retorts and issues at the top of the ascension pipes, it has a smoky appearance; but after it has passed through the tar in the hydraulic main, and traversed the condensers, it has lost this characteristic.

This brings me back to my previous statement that tar is a purifying agent. Let us, then, not look upon it as an enemy, but as a good friend. As soot or solid carbon has no affinity for water or watery vapor—indeed, it repels it—what benefit is there in drawing off the tar and having a water seal, instead of passing the gas through the tar in the hydraulic main? The writer is of opinion that if the gas is allowed to go through the tar, and pass on with it to the condensers, it will remove the finely-divided particles of soot or carbon, and at the outlet of the condensers all the color of the crude gas will have been removed. By using anti-dips, the gas would lose the purifying it gets by passing through the tar. In working inclined retorts it is well not to have a dry main, or one with a water seal, for the reason that as soon as the coke begins to form the sulphur passes away with the gas. The formation of coke generally commences at the top end of the retort; and this coke holds the protosulphuret of iron, which, as previously stated, gives rise to bisulphide of carbon. When the driving off of the volatile constituents begins to slacken, this newly-formed coke gives off some of the sulphur compounds it contains. When the heat, after expelling the constituents of the coal, is made to act upon the newly-formed coke, bisulphide of carbon makes its appearance very fast. No one will deny that coke contains sulphur. By using the original dip-pipes, and a wet main, the gas, by passing through the tar, will lose some of its sulphur compounds. The writer's closing advice to young gas managers and gas students is: Do not have anti-dips if you can avoid it, especially if you have to work inclined retorts. If the hydraulic main is kept clear in the way indicated by the writer in preceding articles, there will be no need of anti-dips.

## The Photometry of the Inclosed Alternating Arc.[1]

By Messrs. Chas. P. Matthews, W. H. Thompson and J. E. Hilbish.

Arc light photometry, in so far as it involves the mere determination of luminous intensity, yields unsatisfactory results for three chief reasons: The first of these is the marked difference in quality between the light of the arc and that of any of the ordinary standards. The photometrist realizes the general unsatisfactory character of the existing standards for the study of sources of a quality similar to that of gas light. Nevertheless, he is vastly better off in this respect than he is in the matter of a standard of suitable quality and intensity for arc light measurement. The eye estimates accurately an equality of brightness in two surfaces only when those surfaces are of the same tint. Moreover, with a color difference the judgment of an equality differs with different observers. It should be said, however, that the difficulty arising from difference of color is less troublesome in the case of the inclosed arc than in the case of its progenitor, the open arc. The inner, opalescent globe absorbs the rays of short wave length in greatest proportion, a fact which brings the color of the arc nearer that of the standard. When an outer globe of milky glass is used—the standard being a glow lamp maintained at, or above, its normal voltage—there is no annoyance from color difference.

The second obstacle to careful measurement is to be found in the variability of the quantity to be measured. These variations are largely due to the wandering condition of the arc—a peculiarity that is especially noticeable in the open alternating arc, and in both types of the inclosed arc. Indeed, it is to this feature of the inclosed arc that the flat-ended carbons are due. The change in luminous intensity corresponding to a shifting in the position of the arc from one side of the carbons to the other side is enormous. An attempt to get at the intensity of such a source by a few readings might easily lead to results discordant by 100 per cent. or more. The only hope of securing a result that will show the mean intensity of the arc is in taking a large number of settings, distributed as to time with some degree of uniformity. To accomplish this it would seem desirable to do away with the considerable and variable interval of time used in the ordinary process in reading the bar. This end was reached by the use of a mechanical device for recording a setting as soon as it is made by means of a drum immediately below the photometer bar. This permits the observer to keep his eye continually trained on the photometer disk, so that all the major fluctuations may be readily followed and recorded, and this without the visual fatigue resulting from introducing light into the photometer room. The act of depressing a rod attached to the carriage makes a permanent record on the paper surrounding the drum, and at the same time advances the drum so that the record may be subsequently identified.

The inaccuracy of photometric settings, due to the causes just mentioned, is perhaps more a question of process than of principle. There is a third and more fundamental source of trouble—one, indeed, which brings into question the validity of the term "candle power" as a measure of worth in illuminants.

For the sake of clearness, let us first consider what the term means. A 16-candle power lamp, for example, is one that produces at a distance of 4 units the same illumination that 1 candle produces at 1 unit. That is, if two similar surfaces be illuminated separately by these two sources at these distances, and if they be viewed in juxtaposition from the same direction, they appear equally bright. This is, in fact, what the photometer shows, and is really all that can be affirmed with a result of the comparison. Having established a distance ratio of 4 : 1, the observer applies the law of inverse square to calculate an intensity ratio of 16 : 1. This intensity ratio is numerically equal to the illumination ratio on two surfaces at unit distance, but it is important to note that an observer would be quite unable to assign a numerical value to the relative illumination of these surfaces. In other words, the optical stimulus varies as the inverse square, but, by Fechner's law, the sensation varies as the logarithm of the stimulus—a fact of which we cannot take direct cognizance. Thus the intensity or "candle power" ratio of two sources is a derived quantity, of indirect significance, whose chief value is to be found in the fact that it enables one to calculate an indefinite number of pairs of distances, at each of which will be found an equality of illumination. If two sources be compared by some method which takes account of their quality, and which gives as a result the ratio of their total luminosities—determined, say, by the relative value of their component rays in distinguishing characters—something quite different from their "candle power" ratio may be obtained.

For the photometric measurements which were carried out in the electrical laboratory of Purdue University a Krus-Bunsen photometer was used. The method adopted was the usual one of a swinging crane in connection with a 45° mirror. The standard source was a glow lamp; it was referred after each test to the Hefner lamp.

A number of inclosed arc lamps, in their commercial form, were kindly placed at the disposal of the writers by their respective manufacturers. As this paper has no other object than to exhibit such features of the performance of these lamps as are largely typical, the lamps will be designated only by letters.

1. Read before the American Institute of Electrical Engineers.

The distribution of intensity from lamp *A* is shown in the polar diagram of Fig. 1.

The following is a summary of the results of the test of this lamp:

| | |
|---|---|
| Volts | 103.20 |
| Amperes | 5.84 |
| Apparent watts | 602.00 |
| True watts | 407.00 |
| Watts in mechanism | 80.00 |
| Watts in arc | 327.00 |
| Power factor | 0.67 |
| Mean spherical intensity | 110.50 |
| Watts per mean spherical Hefner unit* | 3.68 |
| Watts in arc " " " | 2.96 |

* 1 Hefner unit = 0.88 candle power.

The lamp was intended for an electromotive force of 104 volts, and the attempt was made to keep it at this pressure, but at the close of the test the average electromotive force proved to be 103 2. The power factor is due to the inductance of the mechanism, as it has been clearly established by Blondel that, in the arc itself, the electromotive force and current are strictly in phase. It is easy to confirm this fact by current, pressure and power readings taken with reference to the arc alone.

The upper and lower lobes of the distribution curve do not yield quite the same mean values. The discrepancy is due, no doubt, partly to the fact that the bulb about the arc is not of symmetrical curvature, and partly to the greater reflection from the parts of the lamp situated just above the arc. The shape of the distribution curve alters somewhat as the burning of the carbons progresses. The general shape of the curve is not far from that which has been obtained for the open arc. In the inclosed arc the lobes of the distribution curve are shorter, blunter, and extend outward at smaller angles with the horizontal. These changes are due to the shape of the carbon points. It may be pointed out that the distribution curve as plotted above is a half-section of the mean photometric surface, which is a surface of revolution. The actual photometric surface—so far from being a surface of revolution—is continually swelling, contracting and twisting in a marvelous fashion. As to whether the light thrown upward is of value will depend on whether the light is suspended in the open air or under a reflecting ceiling. In most cases considerable benefit will be obtained by the use of a reflector, as is illustrated in the following figure.

Lamp *B* was provided with a bell-shaped reflector of milky glass. The effect of the reflector on the distribution curve is very noticeable, the upper lobe being largely removed. (Fig. 2.) The minimum corresponding to the horizontal is displaced downward by about 10°. This peculiarity cannot be ascribed to the presence of the shade, as it was found in one or two cases where the lamps were fitted with inner globes only. It is quite surely due to the fact that the carbons so burn that the planes of their ends, although parallel, are rarely normal to their axes.

Lamp *C* was provided with an outer spherical globe of milky glass. The data obtained for the distribution of intensity are plotted in Fig. 3, where the inner curve shows the distribution with the outer globe in place. This distribution is in some respects anomalous. The larger area below the horizontal is due to the presence of a narrow reflector placed inside the outer globe. No reliable reason can be given for the presence of the maximum at 20° above. It may be due to some lack of accurate centering of the carbons. The peculiar shortening of the radii of the inner curve in the lower angles baffled the observers for some time. It was finally found that the milky glass of the outer globe was much more dense in the lower hemisphere than in the upper, and the absorption was correspondingly greater.

It should be said in connection with the inner curve that the amount of light cut off was in reality not so great as the figure indicates. The dispersion is so great with a globe of milky glass that the globe plays a strong part as a radiant. Now, the mirror used was not sufficiently large to furnish rays on the photometer disk from all parts of the globe, and hence the lamp was not given quite full credit for what it was doing.

The results of the test of this lamp may be summarized as follows:

| | |
|---|---|
| Volts | 110.00 |
| Amperes | 7.00 |
| Apparent watts | 770.00 |
| True watts | 484.00 |
| Watts in mechanism | 116.00 |
| Watts in arc | 364.0 |
| Power factor | 0.63 |
| Mean spherical intensity | 83.80 |
| Watts per mean spherical Hefner unit | 5.76 |
| Watts in arc " " " | 4.34 |

In Fig. 5 are shown the fluctuations in intensity which occur in the inclosed alternating arc. With the recording device already described it is possible to get settings of fair accuracy with a considerable degree of rapidity, as is here shown. The large changes in intensity are plainly noticeable in watching the arc, but the eye does not furnish an estimation of them comparable with that to be gained from the curves, for the psycho-physical reason already referred to. It will be noted that the higher values shown in Fig. 5 are of more infrequent occurrence than the lower values. Indeed, it is only when the arc is toward the photometer and flaring out so that both craters are inclined toward the disk that these extreme values are obtained, and then they last but an instant. For all other positions of the arc, whether on the sides or on the back, only the lower values are obtained.

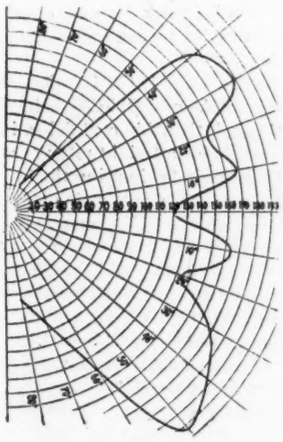

Fig. 1.

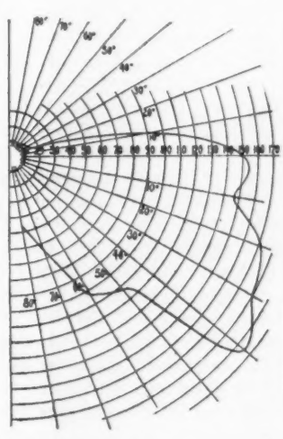

Fig. 2.

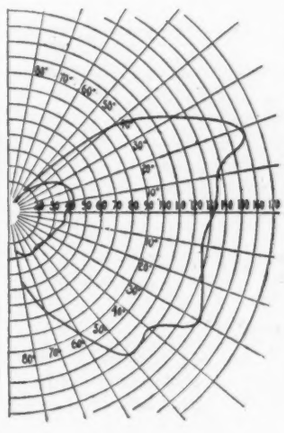

Fig. 3.

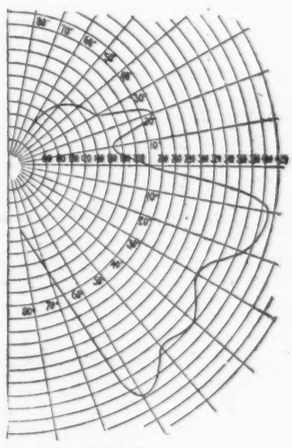

Fig. 4.

Two causes, it was thought, might contribute to such fluctuations—namely, the changing length of the arc and the "wandering" character of it. To test this the curve in Fig. 5 was taken with a fixed length of arc, the clutch being entirely out of action. The result plainly shows that the chief cause of the fluctuations is the hunting of the arc. While the intensity varies with the length of the arc, the motion of the carbons is so slight in a well-regulated lamp that it plays little if any part in causing the variations shown.

Measurements were made on a direct current lamp of the same manufacture as lamp *A*, with a view of bringing this type of lamp under conditions identical with those of the tests of the alternating arc. The lamp was fitted with an inner opalescent globe only. The distribution of intensity is plotted in Fig. 4. This curve was taken with great care, and may be taken as typical of the distribution due to the inclosed arc fed by a direct current. The peak at 20° above is due to the small crater of the negative carbon. Here also the depression in

the curve due to the low luminosity of the arc is found displaced by 10° above the horizontal. This lamp will give an excellent illumination at points somewhat remote, because the curve is so full in the region just below the horizontal. A shade would still further improve the lamp in this respect. Detailed results are given in the following table:

| | |
|---|---|
| Volts | 108.00 |
| Amperes | 4.96 |
| Watts | 536.00 |
| Watts in mechanism | 152.00 |
| Watts in arc | 384.00 |
| Mean spherical intensity | 197.30 |
| Watts per mean spherical Hefner unit | 2.72 |
| Watts in arc " " " | 1.95 |

As regards efficiency, or better economy, say in watts per Hefner unit, the direct current lamp is superior to its alternating current competitor. The performance of lamp *A* was the best found in these tests, that of lamp *C* the worst. The other lamps tested showed different degrees of economy lying between the limits set by these two.

The writers feel justified in saying that the lamps of low economy could, by improvement in mechanism, be brought to a performance equal to that of lamp *A*. All the lamps tested, with one exception, were furnished with the same brand (Electra) of carbons, and all had opalescent inner globes. With similar carbons and similar globes a difference in economy must be attributed largely to the mechanism.

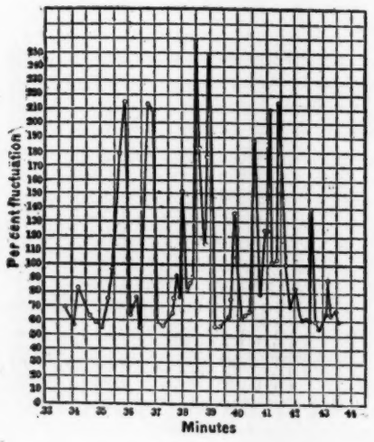


**Fig. 5.**

If the alternating arc be regarded apart from any regulating device, the physical reasons for its poorer qualities as a light source are to be found in the lower temperature of the glowing points and in the diminished area of crater surface. In the direct current arc we find two bright surfaces of unequal area and of widely different temperature. In the alternating current arc we find two bright surfaces of the same area and of the same temperature. According to Rossetti, the temperatures in the first case are 3,900° C. and 2,700° C. Now the points in the alternating arc are as much positive as negative, and hence, whatever the unknown law connecting the temperature of glowing carbon with the intensity of the light due to it, we should expect the mean spherical intensity of the alternating arc to have a value intermediate between the values of mean hemispherical intensity for the upper and lower lobes of the distribution due to the direct current arc. A comparison of lamps *A* and *D* shows this point, although the total power is not the same. If the power consumption of the alternating arc were raised from 327 to 384, it is very probable that the mean intensity would be found raised from 110.5 to a considerably higher intermediate value.

The values of the intensity of the direct current lamp are lower than those found by some earlier observers. In fact, the inclosed arc has been reported in some instances as quite equal to the average open arc. It is difficult to see how these results can be accurate for a lamp fitted with an opalescent globe. The results of a test recently reported by Nichols agree closely with those given for the direct current lamp in this paper.

## Competition of West Virginia with Ohio Coal.

Mr. E. H. Coxe, writing in *Engineering and Mining Journal* on the topic named in the heading, says:

West Virginia is a thorn in the side of the coal operators of Ohio, and of Western Pennsylvania, too, for to a certain extent the conditions are similar in both States. This thorn has been growing sharper from year to year for several years, and some of the Ohio operators are now seeking and gaining a foothold in West Virginia as their only salvation, thus competing against themselves. From observations in both States, the writer has been enabled to note some of the conditions governing the competition between them.

First and foremost of these is the cheap West Virginia labor, or, we might say, the high-priced Ohio labor. The Ohio operator is tied hand and foot by the miners' union, and the prices paid for mining and other labor are fixed annually, or oftener, by a joint convention of operators and miners. The last convention, held in Chicago, adopted on April 1 of this year a scale of prices for one year, and fixed eight hours as a day's work. According to this scale the price paid for pick mining, which must be adhered to, is 66 cents per short ton of screened lump coal passing over a 1¼-inch bar screen of specified size and shape. Mining includes undercutting, blasting, and loading in the mine car at the working place of the miner. There is a large extra pay for entries, break throughs, room necks and all other narrow work. Track layers are paid $1.90 per day, drivers and most other inside and some outside labor $1.75 per day, with numerous other prices, both higher and lower, for different kinds of work. Blasting and loading after machines is paid one-half the price of pick mining. In Pennsylvania, owing to numerous conditions affecting competition and labor, a differential of 9 cents per ton over Ohio price is paid for pick mining. This makes the present price in that State 75 cents per short ton. In West Virginia, where they have no union, except in very few places, the price paid for pick mining varies from 30 cents to 60 cents per long ton, over screens varying from ½ inch to 2 inches, and with correspondingly low extra pay for narrow work. The price of day labor runs from about $1.25 to $1.75 per 10-hour day, according to locality and nature of work. In each case each individual operator gets his work done as cheap as he can. In some cases they pay for mining by the car, sometimes increasing the size of the car after the price is fixed.

Another important factor in the competition is the fact that some of the large railroads, notably the Chesapeake and Ohio, and the Norfolk and Western, which do not pass through the Ohio coal fields, haul the West Virginia coal into the Ohio markets for a freight rate not much in excess of the rate charged by the Ohio roads for hauling the Ohio coal; and the Ohio roads will not or cannot make a rate which will enable the Ohio operator to meet the price of the West Virginia coal. Some roads hauling from both States, and even owning coal in Ohio, meet the low rate for West Virginia coal, but will not help the Ohio man.

To day in almost any Ohio town, outside of the coal regions, and in Chicago, or any of the cities of the Northwest, West Virginia coal can be bought from 25 to 50 cents per ton cheaper than Ohio coal, and many Ohio operators claim to be losing money at that, while the West Virginia operators seem to be thriving and growing fat.

In most localities in Ohio there is in the seam from 1 foot to 2 feet of refuse, including bone coal and slate, which must be handled, while in the West Virginia coal this does not occur, though there is from 1 inch to 3 inches of slate in some cases. While the West Virginia seams are thinner in some places, still there is not this dirt to handle, and what they have is coal, not refuse. In Ohio there occurs only one workable seam in each locality, except in rare instances, while in most localities in West Virginia there occur from two to four workable seams, separated vertically by 75 feet to 300 feet. In many cases three or four seams are worked at one time with one tipple.

Most of the West Virginia coal worked at the present time is well up in the hills, while a considerable part of the Ohio coal is level with or below the valleys, making it necessary to work it by slope or shaft, while the West Virginia coal is worked by incline, the weight of the coal furnishing the power which brings it down the hill and takes the empty cars back up. Another important factor which we cannot deny is the superior quality of the West Virginia coal for most purposes, and if the buyer can get a superior coal for less money than the inferior coal, of course he is going to take it.

Very little of the Ohio coal will coke, and there is very little market for the slack, except what is shipped in run-of-mine coal; which fact is attested by the enormous slack piles at most of the Ohio mines. This slack must in some way be conveyed from the screen to the slack pile, which of course takes labor or expensive machinery. In West Virginia the slack makes in most cases an excellent quality of coke, and besides it has a ready market at a good price, as it is an excellent fuel for many purposes.

This West Virginia coal, being softer than the Ohio coal, could, with the same labor, be mined more easily and cheaply. Being higher in the hills, the mines are more easily and cheaply drained and ventilated.

West Virginia mining laws, being less stringent than Ohio laws, much less attention and expense are spent in the way of ventilation, and much narrow work, in the way of break-throughs, is saved.

Every strike in Ohio—and they have had about one a year for the last six or eight years—has resulted in a harvest for the West Virginia operator and miner, and the transfer of a large amount of business from the former State to the latter, much of which is never recovered. When one of these strikes occurs and an attempt is made to organize the West Virginia miners, the operators raise the price of coal (which they can easily do at such a time) and the pay of labor to keep them at work. And while some of the miners there have been organized for short spaces of time, the United Mine Workers of America have never succeeded in getting any kind of a foothold in that State.

There seem to be very few ways to equalize matters. As I have said, the union has not succeeded in getting the West Virginia miners into its fold. One reason for this is that, instead of getting them thoroughly organized before calling a strike, they call the strike first, and then, when the West Virginia miners are profiting thereby, try to get them out too. The other alternative is for the Ohio miners to come down to such a price for mining as will enable the Ohio coal to compete with that from West Virginia. If they do this and recover some of their lost business they might, in the course of a few years, when the miner from the Mountain State sees that he is no better off than his organized Buckeye brother, induce him to go into the union. But when the non-union men are working steadily, while the union men are hardly working at all, it is naturally hard to convince him that the union would benefit him. There being an overproduction of coal in this country at the present time, it is hard to see, under existing circumstances, how the coal business of Ohio is to improve as long as the United Mine Workers fight for a high wage scale and the cheap West Virginia output is steadily increasing. Notwithstanding the fact that at the present time many Ohio mines are working on an average of not more than one and a half or two days a week, and some not at all, the union miner will not be convinced that half a loaf five or six times a week is better than a whole loaf once or twice.

## ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. J. E. D'Alemberte has been elected Secretary and General Manager of the Pulaski Gas Light Company, of Little Rock, Ark., vice Mr. J. T. Pullen, resigned.

Messrs. A. J. Gale and A. A. Gale have purchased a large interest in the Albion (Mich.) Gas and Coke Company. As a result of such purchase the following executive management has been named: President, A. J. Gale; Secretary, W. E. Foote; Treasurer, E. P. Robertson.

The D. M. Steward Mfg. Company, of Chattanooga, Tenn., has established a sales headquarters in this city, at 107 Chambers street, in order that its rapidly increasing business in this section might be all the more properly cared for.

We understand that Messrs. William and Christopher Luebkeman have secured a controlling interest in the Eau Claire (Wis.) Gas and Fuel Company, through purchase of the shares heretofore held by Mr. W. H. Watson. The new owners propose to rebuild the plant, although it is not likely the betterment will be undertaken before next spring.

Mr. John I. Young, whose clever and well sustained services in connection with the Treasurership of the Newark (N. J.) Gas Light Company will be remembered by many of the older members of the fraternity, died at his home in Newark on the morning of the 8th inst. Mr. Young was born in New York in 1807.

A. L. Judson, of Albany, N. Y., is reported to have applied for a franchise to supply gas and electric lights, etc., in Saratoga, N. Y. From the point of view of the ordinary observer, Saratoga would seem now to enjoy an adequate supply of light on either or both of the named accounts.

Mr. Paul Huntzsch has been appointed Secretary and Treasurer of the Fresno (Cal.) Gas and Electric Light Company, and Mr. George Colquhoun has been chosen Superintendent of the same Company, vice Mr. A. Gutsch resigned.

Mr. Edward Betts, President of the Wilmington, Del., Coal Gas Company, acting under instruction of the Board of Directors, under date of the 5th inst., issued the following circular to the shareholders:

"The continued growth of our city and the increased consumption of gas make necessary the enlargement and improvement of our works and the extension of our mains, in advance of building operations. To provide means for such additions the Board of Directors this day authorized an increase of the present capital stock of the Company, from $550,000 to $600,000, by the issuing of 1,000 shares of new stock at par ($50 per share), *pro rata* to stockholders, as registered at the close of business this day. You are therefore entitled to subscribe for one share of this new stock for each 11 shares then held by you, subject, however, to the following conditions:

"1st. Stockholders must notify the Company of their acceptance of this privilege, and pay one half of the amount required, on or before the 15th day of November next, for which payment scrip, signed by the President and Treasurer, will be issued, subject to a further payment of $25 per share, on or before the 15th day of February next, after which second payment stock certificates will be issued on the surrender of the scrip.

"2d. No interest will be allowed on any payments, nor will the new stock be entitled to any dividends before August, 1899.

"3d. While advanced payments may be accepted to accommodate subscribers, in no case can the new certificates be issued before February 15th, 1899.

"4th. Failure on the part of any stockholder to accept this offer on or before November 15th, 1898, will forfeit the privilege herein granted.

"5th. Shareholders not wishing to subscribe, or those holding less than 11 shares, or those having shares in addition to what they subscribe upon, may assign their privileges to others, on blanks furnished by the Company, such privileges being convertible into stock, when presented in sums of $50, or multiples thereof."

On July 7th, 1897, the electors of Tyrone, Pa., voted in favor of increasing the borough debt for the purpose of purchasing the plants of the Tyrone Gas and Water Company, for operation on municipal account. The owners of the plants and the authorities could not agree upon a price for the transfer, and the matter remained in abeyance until the first week this month, when the Council passed a resolution instructing its Legal Committee to offer the Gas and Water Company $90,000 for its assets, property and franchise. The resolution further declares that if the named sum is not accepted proceedings under the provisions of the State laws applying in such cases, for the condemnation of the property, are to be at once instituted.

Attorney-General Hancock has granted the application of Messrs. F. B. Thurber, William McCarrol and others, for permission to bring an action in the Supreme Court to forfeit the franchises and charter of the City Gas Company, of New York, which Company was incorporated in 1865. It is alleged in the application that it has forfeited its corporate rights and should be dissolved upon the grounds that its capital stock was not paid in within two years after its incorporation; that it has failed to file annual reports; that it has suspended its ordinary and lawful business for over one year; and that it has forfeited its privileges and franchises by failure to exercise its powers.

A correspondent forwards the following, under date of October 8th: "A meeting of the creditors of the Bath (Me.) Gas and Electric Company was held some days ago. Many of the local creditors were present, and the creditors of other cities were: Geo. F. West, of Portland, Me.; F. Dillion, of Fitchburg, Mass.; A. N. Williams, of Boston; R. E. Goodwin, of Augusta, Me.; R. L. Snow, of Portland, Me.; and H. A. Randall and Weston Thompson, of Brunswick, Me. Mr. H. A. Duncan acted as Chairman of the meeting, and Mr. Chas. W. Taylor acted as Secretary. Mr. C. C. Low, for the assignees, submitted a report which placed the assets at $229,586.18 and the liabilities at $264,891.01. In the liabilities are scheduled $32,654.95 on account of bills payable, and $115,236.06 on account of notes payable. On motion of Mr. West, Messrs. West, Jno. R. Kelley and E. W. Hyde were appointed a committee to examine the existing conditions and the prospects thereof for the future, the committee to report to the creditors their findings and a plan of action to be taken. It was also voted to employ an expert to examine the books of the Company. Some pretty plain talk was indulged in during the meeting."

We understand that some of the gas stove makers have formed a permanent Association, the main purpose of which is said to be "the regulating and controlling of discounts for cash." The officers of the

Association are: President, D. A. Dangler; Vice-President, J. R. Conway; Secretary and Treasurer, F. H. Willis; Chairman Executive Committe, G. B. Gunderson.

THE proprietors of the Palmyra (N. Y.) Gas Light Company have reduced the selling rate to $1.50 per 1,000 cubic feet.

MR. SOLON HUMPHREYS, Manager of the Bayonne and Greenville (N. J.) Gas Light Company, says that the United Gas Improvement Company, which controls the first named Company, has no intention of shutting down the Bayonne plant.

THE C.W. Hunt Company, of West New Brighton, N. Y., informs us that it is ready to supply, on application to its publication department, copies of its three new catalogues, respectively entitled: "Industrial Railways;" "Mast and Gaff Fittings, Coal Tubs, Hoisting Blocks and Wheelbarrows;" and "Manila Rope for Hoisting and Power Transmission." Each of these catalogues contains much valuable information in concise shape.

WE understand that the proprietors of the Charlotte (N. C.) Gas Light Company have sold that property to the United Gas Improvement Company, the sale having been made through Dr. John H. McAden. The Charlotte *Observer* reports that the rate paid was $150 per share, at which figure we have no hesitation in saying the purchasers secured a decided bargain.

A CERTIFICATE recently filed with the Secretary of State of New Jersey declares that the stock of the Peoples Gas Improvement Company, of Trenton, N. J., has been increased to $1,500,000, from $325,000.

THE Trustees of West Hartford, Conn., have voted to permit the Hartford City Gas Light Company to lay its mains in any of the streets of West Hartford, provided that when the Company desired to open a street or streets it must obtain a written permit, signed by two of the Selectmen, and that it furnish a bond to protect the town against any claims for damages in consequence of completing the necessary excavations.

AN agreement has been reached between the Fidelity Trust Company, of Newark, N. J., and the recent purchasers of the Newark Gas Company, through which the former takes the bond issue of $3,500,000 that the latter proposes to make. The bonds are to run for 50 years, the interest rate to be 6 per cent. The new issue will, with the addition of the present outstanding bonded indebtedness of the Company, bring its bonded debt up to $7,500,000. It is said to be the policy of the owners to issue later on a share capital amounting to $2,500,000. All these things will be completed next month. It is said that Mr. Thomas Nevins, Jr., who has been actively engaged with Senator Smith in changing the conditions of ownership of the Newark Company, will be named President thereof.

THE Somerset (N. J.) Gas Light Company, to manufacture and distribute gas in Somerville, N. J., has been incorporated with a capital of $25,000. Mr. A. M. Young is said to hold 237 shares of the stock. Is this another link in the Jersey new gas chain?

THE *te deum* seems to have the precedence just now in the order of affairs of the International Standard Manufacturing Company, of New York, for a receiver has been appointed to wind it up. At any rate, Judge Smythe, of the Supreme Court, has named Mr. James J. Nealis to administer its property, on the application of Mr. William F. Nettling, to whom is owed $642 for rent. The Rev. William H. Russell was the Company's President.

ADVICES from Philadelphia, per the *Inquirer* of that city, are to the effect that the Committee on Works and Extensions, of the Councils Committee on Gas, has reported against the ordinance providing for the redemption of the gas works from the United Gas Improvement Company, at the end of the latter's first term of ownership, which would terminate in 1907.

WHAT might have been a disastrous fire to the New Haven (Conn.) Gas Company, through the destruction of its new coal dock, was averted by the promptness of the gas works employees. The flames started in the engine room that controls the shute apparatus of the dock, but the man in charge was sufficiently alert and quick witted with his own fire force to render the service of the New Haven fire department not necessary when the department engines "came to hand."

IT is said that Mr. Aldrich and others would like to build and operate a gas works at Springfield, Mo. There is no likelihood that an opposition franchise will be granted.

THE reported strike or finding of an oil well in the Coalinga (Cal.) district, yielding 700 barrels per day, does not seem to have put down the price of petroleum in that section to a very low figure. Quite the contrary, the selling rate of oil there goes up rather than down.

## Lead vs. Zinc Paints.

Mr. G. R. Henderson, of the Norfolk and Western Railroad, contributes to the *Railroad Gazette* a report of a series of exposure tests to determine the efficiency of lead and zinc paints. For the different materials he reaches the following results:

*Tin.*—The best results were obtained with first coat white lead and second coat white zinc. The second coating of zinc gave generally the best results, and the second coating of lead the worst.

*Galvanized Iron.*—The same remarks apply to galvanized iron that were given for tin.

*Sheet Iron.*—The mixture of one-third white zinc and two-thirds white lead, for both coats, gave the best results on this material, and in general the zinc paints gave better results than the lead paints.

*Poplar.*—The second coats of zinc showed up well on poplar, no matter whether the priming coats were white lead or white zinc or mixed lead and zinc. The lead second coating showed up the worst on this material, but in each case where the second coat was of zinc, totally or partially, the paint was in a perfect condition.

*White Pine.*—The remarks made relating to poplar apply to white pine also.

*Yellow Pine.*—This material seems to be difficult to properly treat with paints; the best results were obtained with the first coat of lead, and the second coat of lead and zinc mixed. Where the first coat was of lead and zinc mixed, or entirely of zinc, the results were poor throughout, which seems to indicate that as a general thing the lead is better for priming on this material.

*Conclusion.*—The lead priming and zinc coating is generally good for tin, galvanized iron, poplar and white pine. Sheet iron showed up best with both coats of mixed paints. Yellow pine appeared best with the first coat of lead and the second coat of lead and zinc mixed. Comparing the materials which were painted, we find that generally poplar retains the paint better than white pine, and would, therefore, be preferred for siding on buildings, etc. Yellow pine seems to be the worst of all for this purpose. Black iron, as a whole, seems to retain the paint better than either tin or iron.

## The Market for Gas Securities.

The market for city gas shares was exceptionally erratic during the week, and a prominent feature was the light volume of trading. Consolidated sold down to 168 and up to 174; the latter price being the one reported at noon to-day (Friday.) The "contest" for business seems so far to have been quite one-sided, with the net gain in meters all on the side of the Consolidated. It is too bad that the gas men seemingly cannot dwell in unity, but if capitalists from Chicago, Albany and other out of-town places will try their hunting game in New York, the only recourse for the owners of the local gas preserve is to take a hand in the shooting. The opinion of close observers is that the New Amsterdam folks are not any better gunners than were those who sailed in the late Spanish fleets, in which understanding the end of the unpleasantness in New York city gas trading must be nigh. The quotations for Mutual show no change; Standards are a trifle weaker; as also are New Amsterdams. Anything on the city list is a purchase, and for a quick turn too.

Brooklyn Union is in some demand, at 122½ to 123; Peoples, of Chicago, is at 104¼ to 104½, and Consumers, of Jersey City, is 80 bid. Under the existing conditions of the gas supply in the State of New Jersey it looks to us that Consumers gas is a good thing to buy at the reported figure asked by holders—85. Peoples, of Jersey City, is 180 bid, but as that rate is at least 20 points under its real value, the quotation may be accepted as nominal only. Lacledes are weaker, and Baltimore gas is steady, at 64 to 65. San Francisco Gas and Electric Company's shares are being inquired for by small investors, which inquiries show how well the Company and its prospects are regarded at home. Cincinnati gas does not change much, but, judging from rumors as to possible readjustment of the Company's capital, it would seem that 225 would not be a high price for the shares.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

MONDAY, OCT. 17, 1898.

## Gas Stocks.

**Quotations by Frederic B. Cochran & Co., Brokers and Dealers in Gas Stocks.**

20 AND 22 BROAD STREET, NEW YORK CITY.

OCT. 3.

☞ All communications will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

| *N. Y. City Companies.* | *Capital.* | *Par.* | *Bid.* | *Asked.* |
|---|---|---|---|---|
| Consolidated | $37,730,000 | 100 | 174 | .. |
| Cental Union, Bonds, 5's | 3,000,000 | 1,000 | 101 | 101½ |
| Equitable Bonds, 6's | 1,000,000 | 1,000 | 105 | .. |
| " 1st Con. 5's | 2,300,000 | 1,000 | 114 | .. |
| Metropolitan Bonds | 658,000 | . | 108 | 112 |
| Mutual | 3,500,000 | 100 | 309 | 312 |
| " Bonds | 1,500,000 | 1,000 | 100 | 102 |
| Municipal Bonds | 750,000 | . | .. | .. |
| New Amsterdam Gas Co. | 13,000,000 | 100 | 25½ | 27½ |
| Preferred | 10,000,000 | 100 | 64 | 65 |
| Bonds, 5's | 11,000,000 | 1,000 | 99¼ | 100 |
| Northern Union, Bonds, 5's | 1,250,000 | 1,000 | 94½ | 95½ |
| New York and East River.. | | | | |
| Bonds 1st 5's | 3,500,000 | 1,000 | 111 | 113 |
| " 1st Con. 5's | 1,500,000 | | 107½ | 108½ |
| Richmond Co., S. I. | 348,650 | 50 | 70 | .. |
| " Bonds | 100,000 | 1,000 | .. | .. |
| Standard | 5,000,000 | 100 | 128 | 131 |
| Preferred | 5,000,000 | 100 | 140 | 150 |
| Bonds, 1st Mortgage, 5's | 1,500,000 | 1,000 | 112 | 114 |
| Yonkers | 299,65 | 500 | 130 | |
| *Out-of-Town Companies.* | | | | |
| Brooklyn Union | 15,000,000 | 100 | 122½ | 123 |
| " " Bonds (5's) | 15 000,000 | 1,000 | 115 | 115½ |
| Bay State | 50,000,000 | 50 | 3 | 3⅛ |
| " Income Bonds | 2,000.000 | 1,000 | .. | 75 |
| Binghamton Gas Works | 456,000 | 100 | .. | .. |
| " 1st Mtg. 5's | 450,000 | 1,000 | .. | .. |
| Boston United Gas Co.— | | | | |
| 1s Series S. F.-Trust | 7,000,000 | 1,000 | 92 | .. |
| 2d " " " | 3,000.000 | 1,000 | .. | 80 |
| Buffalo City Gas Co. | 5,500,000 | 100 | 21½ | 22½ |
| " " Bonds, 5's | 5,250,000 | 1,000 | 93 | 95 |
| Central, San Francisco | 2,000,000 | .. | 105 | .. |
| Chicago Gas Co. Guaranteed Gold Bonds | 7.650.000 | 1,000 | 104 | 104¼ |
| Columbus | 1.144,700 | 100 | 80 | 91 |
| 1st Mortgage | 1,207.000 | 1,000 | 101 | 103½ |
| Consumers. Jersey City | 2,000,000 | 100 | 80 | .. |
| " Bonds | 600,000 | 1,000 | 102 | 104 |
| Cincinnati G. & C. Co. | 8,500,000 | 100 | 202¾ | 203 |
| Consumers, Toronto | 1,600,000 | 50 | 184½ | 187 |
| Capital, Sacramento | 500,000 | 50 | .. | 35 |
| Bonds (6's) | 150,000 | 1,000 | | .. |
| Consolidated, Baltimore | 11,000,000 | 100 | 64 | 65 |
| Mortgage, 6's | 3,600,000 | .. | 107 | 107½ |
| Chesapeake, 1st 6's | 1,000,000 | .. | .. | .. |
| Equitable, 1st 6's | 910.000 | .. | .. | .. |
| Consolidated, 1st 5's | 1,490 000 | | .. | .. |
| Consolidated Gas Co. of N.J. | 1,000,000 | 100 | 16 | 21 |
| " Con. Mtg. 5's | 380,000 | 1,000 | 75 | 80 |
| Consolidated G. & E. Co.'s., Little Falls, N.Y. | 90,000 | 100 | .. | 100 |
| Bonds | 75,000 | .. | .. | 100 |
| Detroit City Gas Co | 4,500,000 | 50 | 65 | 65½ |
| " Prior Lien 5's | 4,598,000 | 1,000 | 94¼ | 94½ |
| Detroit Gas Co., 5's | 428,000 | 1,000 | .. | .. |
| " Inc. 5's | 34,000 | 100 | .. | .. |
| Equitable Gas & Fuel Co., Chicago, Bonds | 2,600.000 | 1,000 | .. | 101 |
| Fort Wa | 2,000,000 | .. | 75 | 80 |
| " Bonds | 2,000,000 | .. | 88 | |
| Grand Rapids Gas Lt. Co. | 1,000,000 | 50 | .. | .. |
| " 1st Mtg. 5's | 1,125,000 | 1,000 | .. | . |
| Hartford | 750,000 | 25 | .. | 145 |
| Indianapolis | 2,000,000 | .. | 115 | 125 |
| " Bonds, 6's | 2 650,000 | .. | 106 | 107 |
| Jackson Gas Co. | 200,000 | 50 | .. | .. |
| " 1st Mtg. 5's | 250,000 | 1,000 | .. | .. |
| Jersey City | 750,000 | 20 | 180 | .. |
| Lafayette Gas Co., Ind. | 1,000,000 | 100 | 78 | 83 |
| Bonds | 1,000,000 | 1,000 | 90 | 91 |
| Louisville | 2,570,000 | 50 | .. | .. |
| Laclede, St. Louis | 7,500,000 | 100 | 46 | 46½ |
| Preferred | 2,500,000 | 100 | 91 | 93 |
| Bonds | 10,000,000 | 1,000 | 105 | 105¼ |
| Madison Gas & Elec. Co. | 400,000 | 100 | .. | .. |
| " 1st Mtg. 6's | 350,000 | 1,000 | .. | .. |
| Montreal, Canada | 2,000,000 | 100 | 200 | .. |
| Newark, N. J., Gas Co. | 1,000,000 | .. | 200 | 220 |
| Bonds, 6's | 4,000,000 | .. | 128 | 130x |
| New Haven | 1,000,000 | 25 | 252 | .. |
| Nashville Gas Lt. Co. | 1,000,000 | 50 | 110 | .. |
| Oakland, Cal. | 2,000,000 | .. | 53½ | 55 |
| " Bonds | 750,000 | .. | .. | .. |
| Peoples G. L. & Coke Co., of Chicago | 25,000,000 | 100 | 104⅛ | 104¼ |
| Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage | 20,100,00 | 1,000 | .. | 108 |
| 2d " | 2,500,000 | 1,000 | 104 | 105 |
| Peoples, Jersey City | 500,000 | 50 | 180 | .. |
| Rochester Gas & Elec. Co. | 2,150.000 | 50 | .. | .. |
| Preferred | 2,150,000 | 50 | 88 | .. |
| Consolidated 5's | 2,000,000 | | 87½ | 90 |
| San Francisco, Cal. | 10,000,000 | 100 | 88½ | 89 |
| St. Paul Gas Light Co. | 1,500,000 | 100 | 49 | 51 |
| 1st Mortgage 6's | 650,000 | 1,000 | 80 | 84 |
| Extension, 6's | 600,000 | 1 000 | | .. |
| General Mortgage, 5's | 2,428.000 | 1,000 | 80 | 82 |
| St. Joseph Gas Co. | 1,000,000 | 100 | .. | .. |
| " 1st Mtg. 5's | 750,000 | 1,000 | .. | .. |
| Syracuse, N. Y. | 1,750,000 | 100 | 17 | 18 |
| Bonds | 1,500,000 | 1,000 | 94 | 97 |
| Washington, D. C | 2,000,000 | 20 | 250 | |
| Western, Milwaukee | 4,000,000 | 100 | 85½ | 86 |
| Bonds, 5's | 3,556,000 | . | 101¾ | 102½ |
| Wilmington, Del. | 550,000 | | 204 | 206 |

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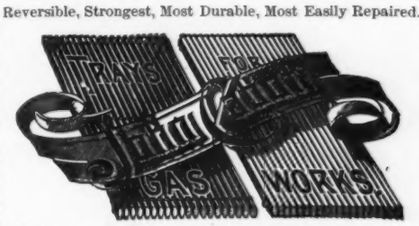


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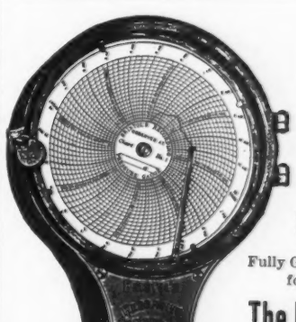

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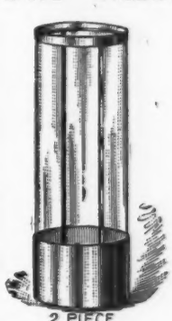


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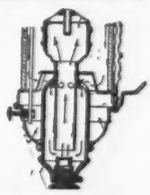

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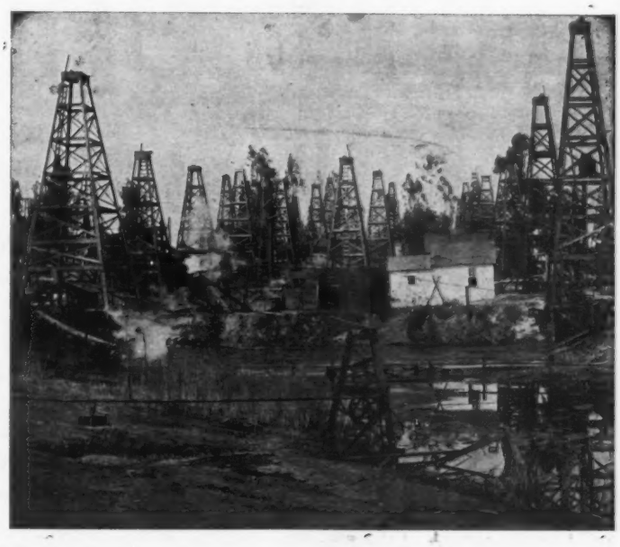

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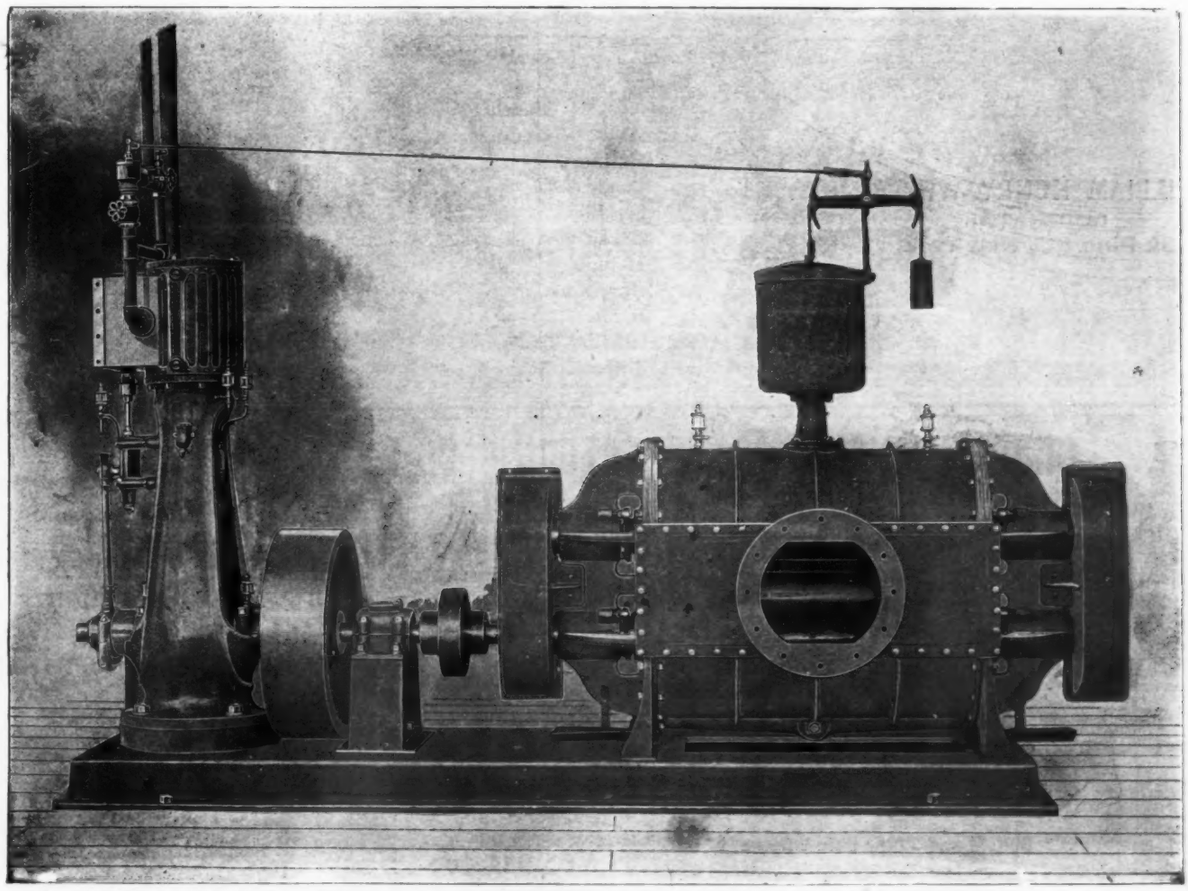

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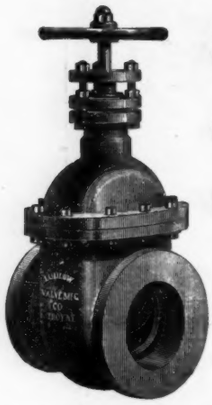

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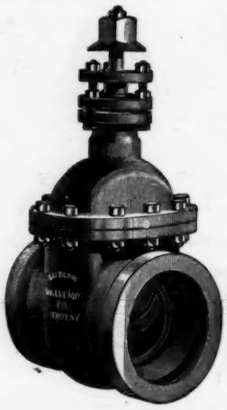

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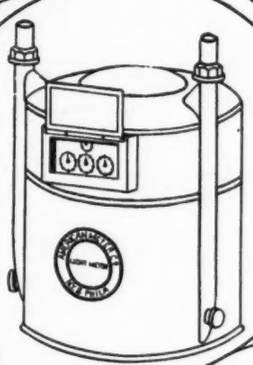
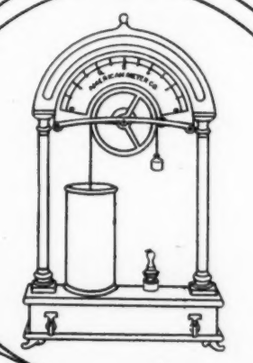
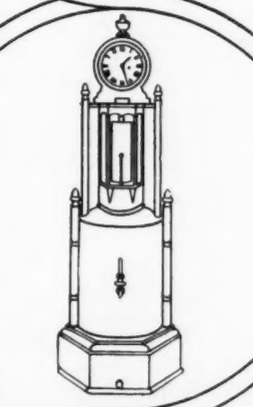
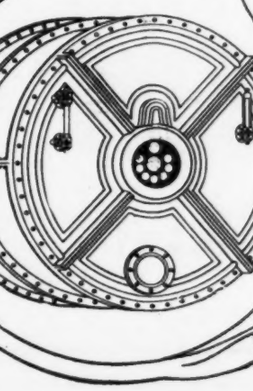




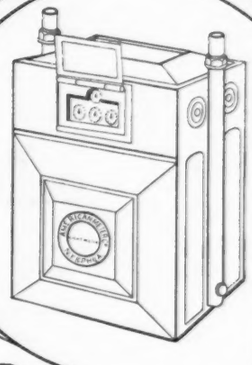


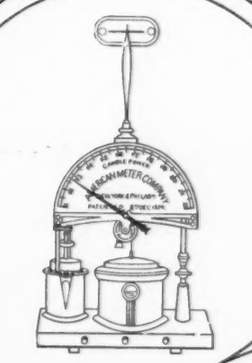


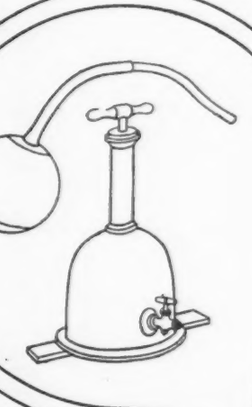
## PUBLIC LIGHTING TABLE.

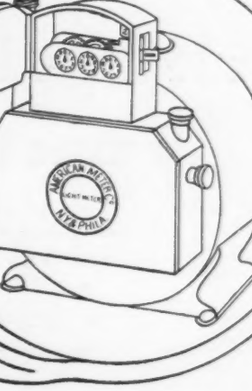
### NOVEMBER, 1898.

| DAY OF WEEK. | DATE. | Table No. 1. FOLLOWING THE MOON. Light. | Extinguish. | Table No. 2. NEW YORK CITY. ALL NIGHT LIGHTING. Light. | Extinguish. |
|---|---|---|---|---|---|
| | | | | P.M. | A.M. |
| Tue. | 1 | 5.30 PM | 8.00 PM | 4.45 | 5.35 |
| Wed. | 2 | 5.30 | 8.50 | 4.45 | 5.35 |
| Thu. | 3 | 5.30 | 9.50 | 4.45 | 5.35 |
| Fri. | 4 | 5.30 | 10.50 | 4.45 | 5.35 |
| Sat. | 5 | 5.30 | 11.50 | 4.40 | 5 45 |
| Sun. | 6 | 5.20 LQ | 12.50 AM | 4.40 | 5.45 |
| Mon. | 7 | 5.20 | 1.50 | 4.40 | 5.45 |
| Tue. | 8 | 5.20 | 2.50 | 4.40 | 5.45 |
| Wed. | 9 | 5.20 | 3.50 | 4.40 | 5.45 |
| Thu. | 10 | 5.20 | 5.40 | 4.40 | 5.45 |
| Fri. | 11 | 5.20 | 5.40 | 4.40 | 5.45 |
| Sat. | 12 | 5.20 | 5.40 | 4.30 | 6.00 |
| Sun. | 13 | 5.10 NM | 5.50 | 4.30 | 6.00 |
| Mon. | 14 | 5.10 | 5.50 | 4.30 | 6.00 |
| Tue. | 15 | 5.10 | 5.50 | 4.30 | 6.00 |
| Wed. | 16 | 5.10 | 5.50 | 4.30 | 6.00 |
| Thu. | 17 | 5.10 | 5.50 | 4.30 | 6.00 |
| Fri. | 18 | 8.40 | 5.50 | 4.30 | 6.00 |
| Sat. | 19 | 9.50 | 5.50 | 4.25 | 6.00 |
| Sun. | 20 | 11.00 FQ | 6.00 | 4 25 | 6.00 |
| Mon. | 21 | 12.10 AM | 6.00 | 4.25 | 6.00 |
| Tue. | 22 | 1.20 | 6.00 | 4.25 | 6.00 |
| Wed. | 23 | 2.20 | 6.00 | 4.25 | 6.00 |
| Thu. | 24 | 3.30 | 6.00 | 4.25 | 6.00 |
| Fri. | 25 | 4.30 | 6.00 | 4.25 | 6.00 |
| Sat. | 26 | No L. | No L. | 4.20 | 6.10 |
| Sun. | 27 | No L. FM | No L. | 4.20 | 6.10 |
| Mon. | 28 | No L. | No L. | 4.20 | 6.10 |
| Tue. | 29 | 5.10 PM | 6.40 PM | 4.20 | 6.10 |
| Wed. | 30 | 5.10 | 7.40 | 4.20 | 6.10 |









## TOTAL HOURS LIGHTING DURING 1898.

| By Table No. 1. | Hrs.Min. | By Table No. 2. | Hrs.Min. |
|---|---|---|---|
| January | 210.40 | January | 423.20 |
| February | 186.40 | February | 355.25 |
| March | 181.20 | March | 355.35 |
| April | 166.10 | April | 298.50 |
| May | 156.40 | May | 264.50 |
| June | 144.30 | June | 234.25 |
| July | 147 30 | July | 243.45 |
| August | 157.10 | August | 280.25 |
| September | 169.50 | September | 321.15 |
| October | 186.00 | October | 374.30 |
| November | 204.30 | November | 401.40 |
| December | 218.30 | December | 433.45 |
| Total, yr. | 2129.30 | Total, yr. | 3987.45 |

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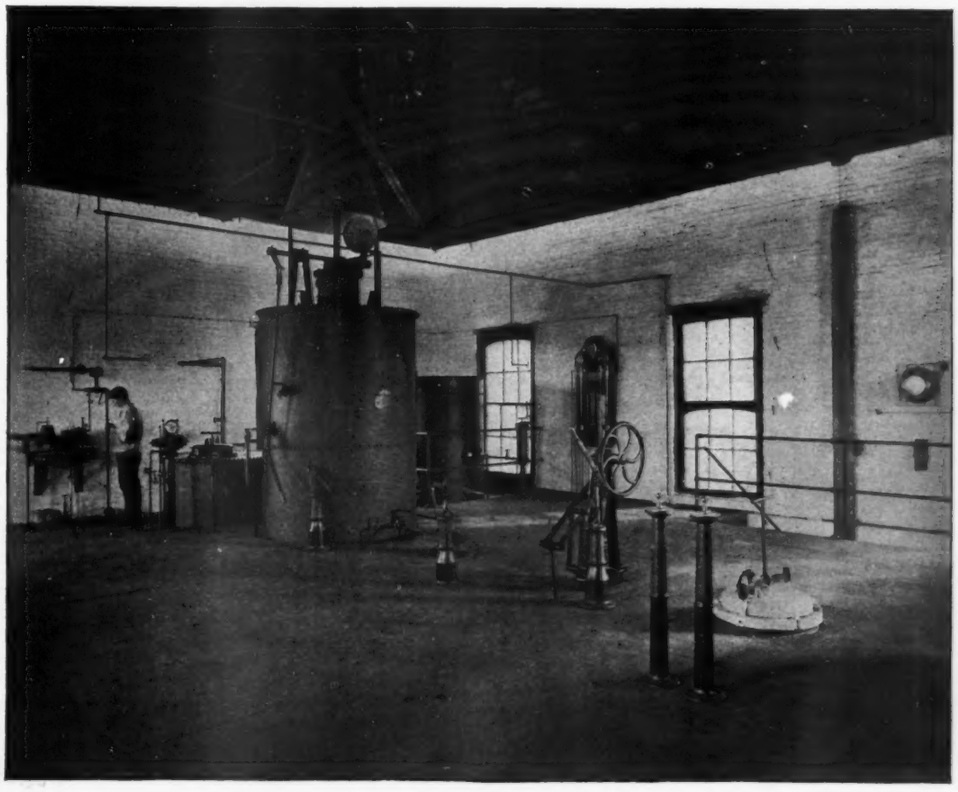

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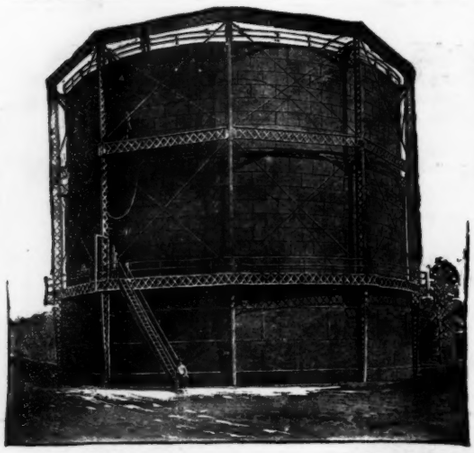

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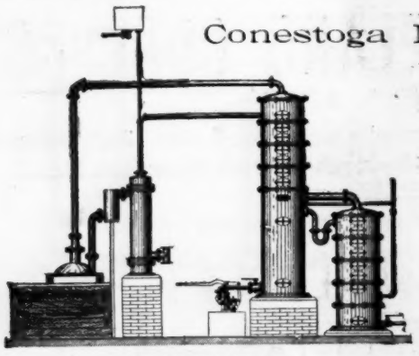

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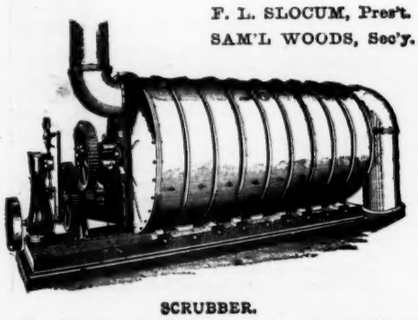

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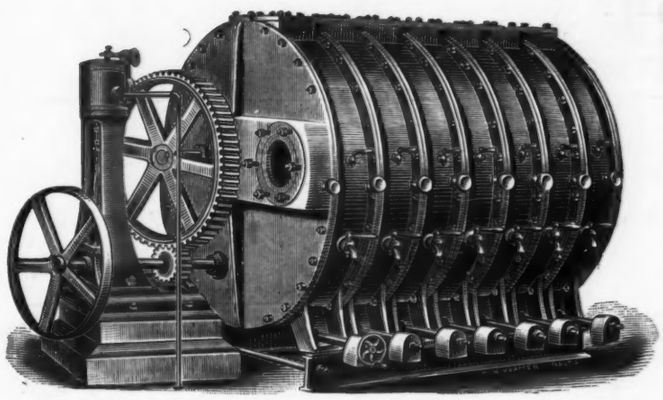

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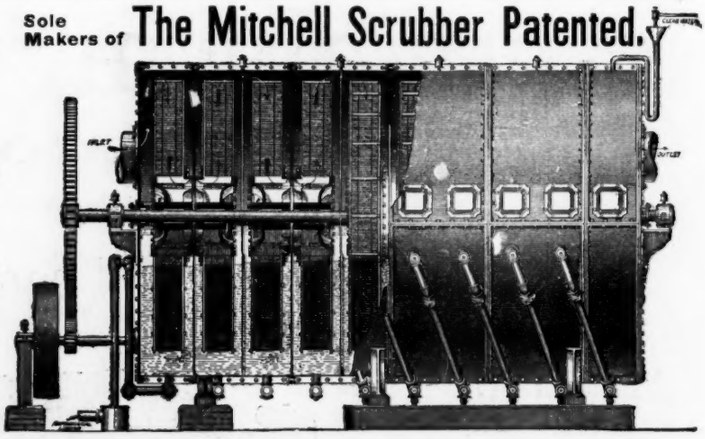

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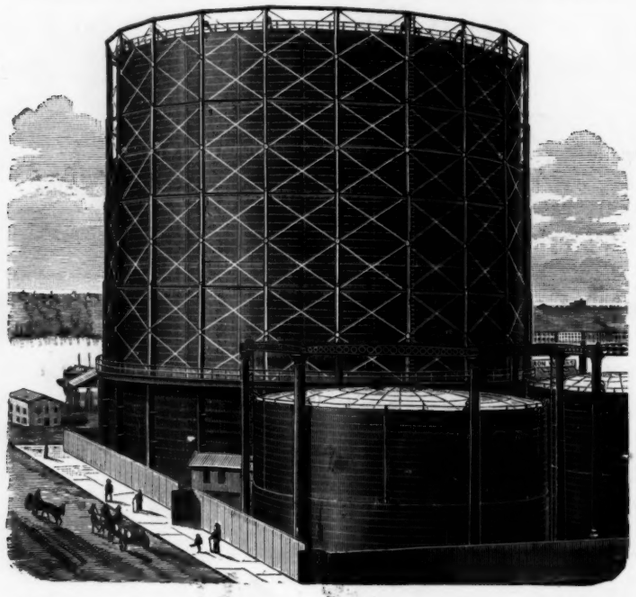

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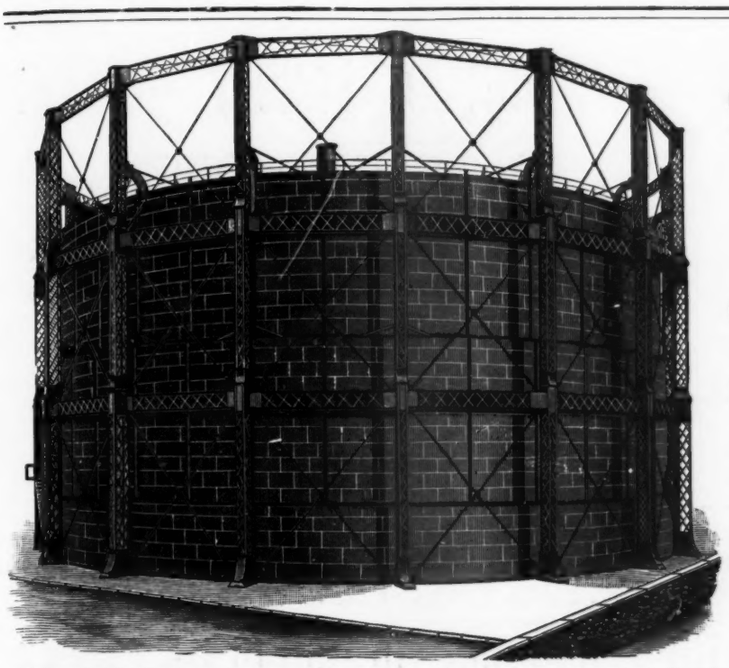

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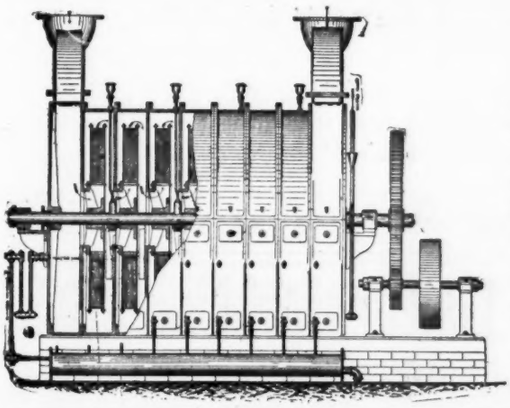

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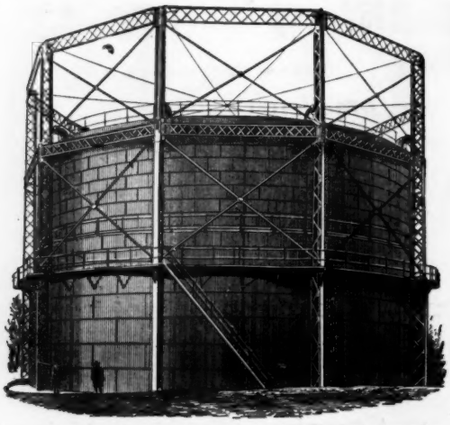

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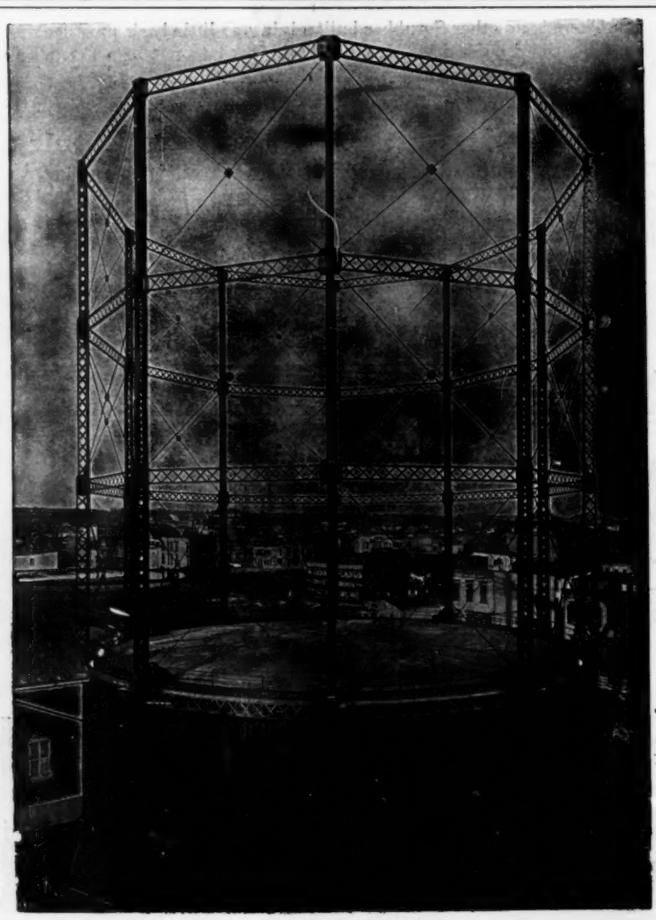

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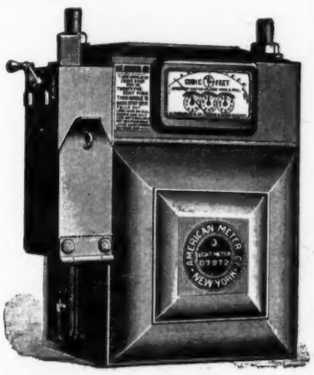

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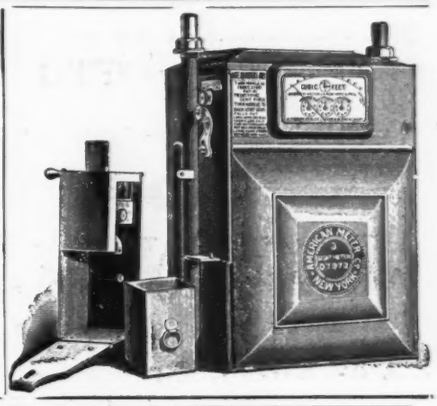

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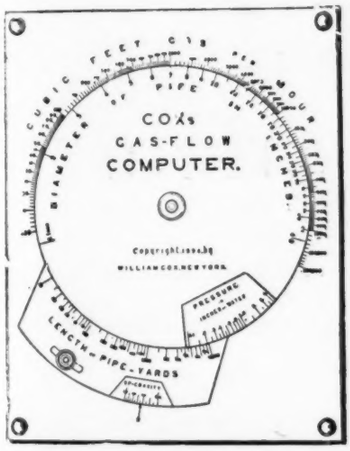


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